PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

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Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21:548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0:536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page 3 of cover*

MATHEMATICS 51

2.25 : 518.12 798
The escalator process for the solution of damped grangian frequency equations. MORRIS, J. *Phil. Mag.*, 275–87 (*April*, 1947).

2.25 : 518.12 799
Note on the Morris escalator process for the solution linear simultaneous equations. FRAZER, R. A. *Phil. ag.*, **38**, 287–9 (*April*, 1947).—The process is expressed matrix notation. L. S. G.

7.212.2 : 534.781 : 621.317.757 : 518.5 *see Abstr.* 802

7.392 : 518.2 800
Table of coefficients for repeated integration with ferences. SALZER, H. E. *Phil. Mag.*, **38**, 331–8 (*May*, 47).

7.93 : 518.5 801
Automatic integration of linear sixth-order differential uations by means of punched-card machines. HAUS-N, L. F., AND SCHWARZSCHILD, M. *Rev. Sci. Instrum.*, , 877–83 (*Dec.*, 1947).—The differential equations are placed by difference equations which can be solved by relay calculators automatically step by step. The final lution is obtained by repeating the integration several nes, each time computing the truncation error and plying it as a correction in the subsequent integration. A.

8.12 : 512.25 *see Abstr.* 798–9

8.2 : 517.392 *see Abstr.* 800

8.5 : 517.212.2 : 534.781 : 621.317.757 802
Photo-electric Fourier transformer and its application to und-films. BROWN, D., AND LYTTLETON, J. W. *Nature*, *ond.*, **160**, 709 (*Nov.* 22, 1947).—The authors have constructed a device very similar to that of Born *et al.* Abstr. 7 (1947), 365 (1946)]. The application is to the alysis of tones recorded on sound film, so that the chief fferences are in the use of a much finer grating, the e of the film itself, moved steadily past the optical perture, in place of a mask, and recording by intensity odulation of the cathode ray oscillograph beam. A ogressive frequency spectrum of the spoken word here" is shown, as analysed by the device.

8.5 : 517.93 *see Abstr.* 801

518.5 : 534.321.3 *see Abstr.* 876

518.5 : 548.73 803
Three-figure cosine factors for Fourier analysis and synthesis. I. A modified stencil method. ROBERTSON, J. M. *J. Sci. Instrum. Phys. Ind.*, **25**, 28–30 (*Jan.*, 1948).—A new set of cosine factor strips is described, operated by a modified Patterson–Tunell stencil method, and designed to give summations at 120ths of the cell edge in crystal analysis. The method is equally suitable for other operations involving Fourier analysis or synthesis. Only one strip is employed for each amplitude, and the sign is indicated by automatic signals, without ambiguity. The complete outfit, comprising strips for a full 3-figure range of amplitude, files, sorting boards and stencils, is very compact and weighs about 6 lb. Application of the method to the calculation of structure factors is outlined. A.

518.5 : 548.735.44 *see Abstr.* 1118

518.5 : 621.3.011.2 804
A resistor network for the approximate solution of the Laplace equation. DEPACKH, D. C. *Rev. Sci. Instrum.*, **18**, 798–9 (*Oct.*, 1947).—Standard ½-W 3 300 Ω resistors are arranged on a board in a network of squares. Potentials can be applied to various points on the board and are measured either by a valve-voltmeter or potentiometer; from the results a solution to the 2-dimensional and axially symmetric forms of the Laplace equation can be derived.

519.2 805
A problem on random vectors. LORD, R. D. *Phil. Mag.*, **39**, 66–71 (*Jan.*, 1948).—A modified solution to a recent problem [Abstr. 511 (1947)] is given, and it is shown that a certain distribution tends to normality as a certain integer increases. A generalization is considered. L. S. G.

519.271.019 806
Over-estimation of probable errors. LESLIE, R. T. *Nature, Lond.*, **160**, 751–2 (*Nov.* 29, 1947).—The usual formula for the combination of probable errors is invalid when the observed quantities are subject only to errors in reading scales, which are therefore limited in size. Alternative formulae are worked out for this case. [See Abstr. 816 (1948)].

ASTRONOMY . ASTROPHYSICS . GEODESY 52

21.042 : 539.155.2 *see Abstr.* 1032

23.11 807
The matter-radiation cycle in the cosmos (and the second law"): the sun's equilibrium. PARSON, A. L. *Nature*, *ond.*, **160**, 906 (*Dec.* 27, 1947).—The author points out at the amount of radiation which does not escape from e observed cosmos would, if only converted into heat re-radiated, maintain a much higher interstellar temerature than that estimated from observation. He oncludes that a process of radiation-matter conversion ust be continuously going on.

23.161 : 537.591 808
The temperature of interstellar matter. I. SPITZER, , JR. *Astrophys. J.*, **107**, 6–33 (*Jan.*, 1948).—The rocesses which tend to increase the equilibrium kinetic emperature of interstellar matter are considered in detail. he equations for the energy gained by photoelectric onization of H and other atoms, by the photodetachment f electrons from H^-, and by photoelectric emission from solid grains are put into a form suitable for numerical computation. Since the electrical charge on the grains enters into the problem, the various physical processes, such as the sticking probability of electrons, which determine the magnitude of the charge on a grain, are also discussed, and the quantitative physical information available on these processes is summarized. The kinetic energy transferred from cosmic rays to the much-less-energetic atoms and grains is treated briefly. A.

523.165 : 523.854 : 621.396.82 809
An investigation of galactic radiation in the radio spectrum. HEY, J. S., PARSONS, S. J., AND PHILLIPS, J. W. *Proc. Roy. Soc. A*, **192**, 425–45 (*Feb.* 18, 1948).—An investigation of the distribution of the sources of galactic radiation at 64 Mc/s is described. Methods are discussed by which the characteristics of the receiving antenna were measured and by which the magnitude of the received galactic power was estimated by comparison with a reference signal of similar amplitude characteristics.

The method of analysis of results is described in detail, with emphasis on the need for allowing for the finite width of the main cone of reception of signal power and for the sensitivity of the antenna to signal sources outside the main cone. The necessary corrections are effected by a method of successive approximations, and contours of the distribution of the signal source between declinations $+50°$ and $-30°$ are derived. The results are expressed in terms of power flux and also of effective aerial temperature. Possible sources of error are discussed and an accuracy better than 1·2 db (30%) is expected for the regions of highest radiation intensity. Reference is made to the fluctuations observed in the radiations coming from Cygnus. The correlation of the derived distribution of galactic radiations with other astronomical data is discussed with special reference to the galactic structure. It is shown that correlation with the near galactic structure, as indicated by the general distribution of visible sources of light, is not very good, but that a more satisfactory correlation is obtained with data which are believed to be characteristic of the structure of the galaxy as a whole. The bias to the south of the galactic circle shown by radiation sources in the vicinity of the galactic centre is especially significant. Various relevant astronomical data are collected together in the accompanying diagrams. The bearing of these correlations on the question of the nature of the source of radiation is examined. It is shown that they do not clearly favour any one theory, and that neither a simple theory in terms of a distributed source in interstellar gas nor one in terms of discrete centres of radiation analogous to sunspots appears adequate to account for the observed phenomena. It is suggested that sources of both types contribute to the observed radiation and that, in general, they must be very distant and associated with the main body of the galaxy. A.

523.374.9 810

Spectrographic observations of the eclipsing binaries of the W Ursae Majoris type, AH Virginis, and TZ Bootis. CHANG, Y. C. *Astrophys. J.*, **107**, 96–101 (*Jan.*, 1948).

523.53 : 537.122 : 551.594.9 8

Electron density in meteor trails. LOVELL, A. C. *Nature, Lond.*, **160**, 670–1 (*Nov.* 15, 1947).—Radio echo are only received from meteor trails when the beam incident normally on the trail, indicating that the electro cloud takes the form of a cylinder of diameter < Quantitative calculations have been made on th assumption of the variation of echo strength with wav length, which are substantially confirmed by simu taneous observations, here reported, made on 72, and 36 Mc/s. The electron density in the meteor tra is estimated as 10^{10}–10^{12} electrons/cm of path.

523.72 : 523.752 8

Solar radio-frequency noise fluctuations and chrom spheric flares. WILLIAMS, S. E. *Nature, Lond.*, **16** 708–9 (*Nov.* 22, 1947).—Records of synoptic observatio of flares and noise on 75 Mc/s are given, which sho frequent instances of bursts of noise being received periods up to 30 minutes after the observation of a fla This supports the theory that plasma oscillations, hi up in the corona, from which the noise originates, a excited by corpuscular emission associated with the fla rather than ultraviolet radiation.

523.746 : 537.591.15 *see Abstr.* 998

523.752 : 523.72 *see Abstr.* 812

523.854 : 621.396.82 : 523.165 *see Abstr.* 809

523.854.3 = 3 8

The structure of the galactic system. V. D. PAHLEN, *Experientia*, **3** (*No.* 12) 471–88 (1947) *In German.*—Th review gives a survey of the development of knowled of the galaxy, its size and shape, directions of moti and distribution of velocity of the stars, and position the galactic centre. There is a long summary in Englis

523.87 : 535.331 8

Fe II emission lines in α Herculis and α Scorpii. HER BERG, G. *Astrophys. J.*, **107**, 94–5 (*Jan.*, 1948).

525.37 : 531.144 : 591.185.63 *see Abstr.* 1132

525.75 : 551.593.5 *see Abstr.* 1129

PHYSICS 53

53.088 815

Optimum instrument response for discrimination against spontaneous fluctuations. DEN HARTOG, H., AND MULLER, F. A. *Physica, 's Grav.*, **13**, 571–80 (*Nov.*, 1947).—A method is presented for dealing with instrument noise of arbitrary equivalent spectral square value $N(\omega^2)$ at the input. When a signal of known shape $f(t)$ and unknown amplitude must be measured, the input signal, necessarily containing the noise, must be averaged with the weight function $1/N(-p^2) \cdot f(t)$. A simple formula is also derived for determining the signal-to-noise ratio. Some applications are given, and qualitative results are collected in a short table. A.

53.088.21 816

Errors in scale estimation. BIRCH, A. J., AND MACDONALD, D. K. C. *Research, Lond.*, **1**, 287 (*March*, 1948).—A galvanometer providing a spot of light crossed by a dark line on a graduated scale was read at intervals while the deflection was slowly rising. Plots of the readings showed a preference for readings close to a scale division. Two causes are suggested: the more easily observed motion of the line when it nearly bisects the space between two divisions; and ignoring by the observer of the thickness of the scale divisions themselves. [See Abstr. 806 (1948)].

FUNDAMENTALS 530.1

530.1 : 538 8

Universal constants in Blackett's formula. TZU, H. *Nature, Lond.*, **160**, 746–7 (*Nov.* 29, 1947).—The co ditions which Blackett's formula [Abstr. 1715 (1947)], true, would impose on any future unified gravitation and electromagnetic field theory are briefly discusse Assuming that the magnetic moment of a rotating bo originates from some cross-terms between the two fie terms in a Lagrangian, then dimensional consideratio indicate that more than two universal constants (G and are required, unless a constant of dimension GP^{q} introduced. Generally, the introduction of univers constants is based on physical principles, and though t principle of charge conservation might be used to intr duce one constant, it is difficult to imagine what is t other, and it may be some new physical principle.

530.12 : 531.113.8 8

Relativity of accelerated motion. MEKSYN, D. *Natur Lond.*, **160**, 834–5 (*Dec.* 13, 1947).—It is pointed out th the transformations between a Galilean and an accelerate space are not necessarily finite throughout the space; accelerated motion is equivalent to a gravitational spac the latter might be expected to have an impenetrab boundary, on which the transformations would becon

nite. This is demonstrated by means of the trans-nations to a space of uniform accelerated motion, and e are applied as a test to the rate of radiation of an elerated electron.

12 : 538.56 819

n the uniqueness of the acceleration transformation. NG, M.-H. *Phil. Mag.*, **39**, 84–6 (*Jan.*, 1948).— transformation coefficients connecting two systems elative accelerated motion [Abstr. 2350, 2472 (1946)] shown to be the only possible ones that give the tromagnetic field the observed values. L. S. G.

14 820

tatistical geometry and fundamental particles. ROSEN, *Phys. Rev.*, **72**, 1253 (*Dec.* 15, 1947).—See Abstr. 8 (1947). An earlier paper by de Broglie [Abstr. 1444 35)], embodying similar ideas, is acknowledged.

14 = 5 821

ynthetic study of a class of elementary particles. DICATI, L. A. *Nuovo Cim.*, **4**, 251–61 (*Oct.*, 1947) *In lian.*—Some properties common to a class of ele-ntary particles of arbitrary spin are studied. In this ss are comprised neutral and charged particles, and ticles with zero rest-mass; in particular all the particles own at present. The theory predicts two kinds of ticles with zero rest-mass, which can be distinguished their behaviour with respect to a generalized gauge-nsformation of the second kind. A.

14 : 539.152.1 822

On the symmetrical vector meson pair theory of nuclear raction. BRULIN, O., AND HJALMARS, S. *Phys. Rev.*, 1126 (*Dec.* 1, 1947).—The charged vector meson pair ory is generalized to include neutral mesons. The ces in this theory are of the exchange type. W. E. D.

14 : 539.18 823

Meson decay and the theory of nuclear forces. LOPES, L. *Nature, Lond.*, **160**, 866–7 (*Dec.* 20, 1947).—The planation of the observations of light and heavy rticles by Lattes *et al.* [Abstr. 417 (1948)] is sought the basis of existing meson theory, e.g. the mixed udoscalar and vector Schwinger theory. Apart from much too short decay time calculated [Abstr. 3661 47)], the emission of a light neutral particle requires use of a non-symmetrical field mixture. Examination the non-symmetrical Møller–Rosenfeld mixture shows t, if a neutral meson lighter than the charged ones is en, it would make the proton-proton potential > the utron-proton potential in the singlet state, which nflicts with experimental evidence. The emission of nt neutrettos in meson decay of mesons thus seems to l for a revision of the present meson field theory.

14 : 539.185 824

Velocity dependence of nuclear forces. SNYDER, H., D MARSHAK, R. E. *Phys. Rev.*, **72**, 1253–4 (*Dec.* 15, 47).—It is emphasized that care is necessary in inter-eting the results of nucleon-nucleon scattering experi-nts. Formulae for the neutron-proton scattering oss-section are obtained by a Møller type calculation scalar and vector meson fields which illustrate the locity-dependence of such formulae. W. E. D.

0.145 825

Particles of half-odd integral spin. LE COUTEUR, K. J. *oc. Camb. Phil. Soc.*, **44** (*Pt I*) 63–75 (1948).—Bhabha's w theory [Abstr. 984, 1632 (1946)] for relativistic rticles is quantized for the case of $\frac{1}{2}$-odd spin, and the eraction of charged vector mesons with a proton-utron obeying Bhabha's equation, classified as $(\frac{3}{2}, \frac{1}{2})$, considered. Scattering cross-sections are calculated, d at high energies Bhabha's equation leads to a value the total cross-section for the charge scattering of mesons that is greater, by 17/9, than the value obtained from Dirac's equation. L. S. G.

530.145 826

Relativistic equations for elementary particles. HARISH-CHANDRA. *Proc. Roy. Soc. A*, **192**, 195–218 (*Feb.* 4, 1948).—From the general principles of quantum mechanics it is deduced that the wave equation of a particle can always be written as a linear differential equation of the first order with matrix coefficients. The principle of relativity and the elementary nature of the particle then impose certain restrictions on these coefficient matrices. A general theory for an elementary particle is set up under certain assumptions regarding these matrices. Besides, two physical assumptions concerning the particle are made, namely, (*a*) that it satisfies the usual second-order wave equation with a fixed value of the rest mass, and (*b*) either the total charge or the total energy for the particle-field is positive definite. It is shown that in consequence of (*b*) the theory can be quantized in the interaction-free case. On introducing electromagnetic interaction, it is found that the particle exhibits a pure magnetic moment in the non-relativistic approximation. The well-known equations for the electron and the meson are included as special cases in the present scheme. As a further illustration of the theory the coefficient matrices corresponding to a new elementary particle are constructed. This particle is shown to have states of spin both $\frac{3}{2}$ and $\frac{1}{2}$. In a certain sense it exhibits an inner structure in addition to the spin. In the non-relativistic approximation the behaviour of this particle in an electromagnetic field is the same as that of the Dirac electron. Finally, the transition from the particle to the wave form of the equations of motion is effected and the field equations are given in terms of tensors and spinors. A.

530.145 : 536.7 *see Abstr.* 957

530.145 : 537.122 *see Abstr.* 960

530.145.6 : 531.19 = 5 827

On the fundamental hypotheses of the intermediate statistics. BORSELLINO, A. *Nuovo Cim.*, **4**, 52–62 (*Feb.*, 1947) *In Italian.*—The hypotheses of the statistics of Gentile are studied from the point of view of wave mechanics, and the difficulties are pointed out that arise if the symmetry properties of wave functions are considered for systems of particles obeying a generalized exclusion principle. In addition, a formula is discussed which is thought to represent correctly the statistical distribution within a gas constituted by a finite number of particles obeying Bose–Einstein statistics. A.

530.162 : 536.48 : 535.43 *see Abstr.* 939

530.162 : 539.172.4 *see Abstr.* 1070

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.113.8 : 530.12 *see Abstr.* 818

531.144 : 525.37 : 591.185.63 *see Abstr.* 1132

531.19 : 530.145.6 = 5 *see Abstr.* 827

531.224 828

The critical load of a battened column. PIPPARD, A. J. S. *Phil. Mag.*, **39**, 58–66 (*Jan.*, 1948).—A theoretical method is developed for determining the strength of struts. This is intended for use with a type of strut, e.g. a battened column, to which it is difficult to apply the ordinary method. L. S. G.

531.224 829

On the cantilever composed of a number of parallel beams interconnected by cross bars. CHITTY, L. *Phil.*

Mag., **38**, 685–99 (*Oct.*, 1947).—The distribution of load in the cantilever is analysed by a method used previously [Abstr. 4748–9 (1932), 828 (1948)]. The problem arises in the study of tall buildings under wind load. L. S. G.

531.252 : 539.42 *see Abstr.* 1099

531.383 : 534.01 830

Gyroscopic effects in a vibratory system. BENNETT, G. S. *J. Appl. Phys.*, **18**, 1110–15 (*Dec.*, 1947).—An analytical investigation is made to determine the influence on a vibrating elastic system of a high speed rotating element. A fundamental condition for the presence of any gyroscopic effect is that the vibration be such as to produce a tilt of the spin vector of the rotor. Equations are derived showing that (*a*) if precession be prevented, no gyroscopic effects are present, (*b*) if precession be permitted, the gyroscopic action contributes a force opposed to the tilt, and proportional to the angle of tilt, in effect increasing the stiffness of the elastic system. Calculations based on an arbitrarily chosen rotor intended to approximate a typical small motor armature indicate that this additive spring force is small, and that the increase in natural frequency caused by the added stiffness is exceedingly small—$\sim 0{\cdot}1\%$—in the case where the precessional motion is not restrained. A.

MECHANICAL MEASUREMENTS 531.7

531.714 : 621.317.39 831

Two useful electromagnetic gauges. BROWN, E. B. *J. Sci. Instrum. Phys. Ind.*, **25**, 4–6 (*Jan.*, 1948).—In both gauges the displacement to be measured moves an iron armature modifying the e.m.f. of two differentially connected transformers. In the first, which is direct reading, the resultant output of the transformers actuates the moving coil of the indicator which is a separately excited iron-cored dynamometer instrument graduated to read the displacement directly. The analytical theory of the direct-reading gauge is given. The second gauge uses an identical gauge head and dynamometer instrument, but the latter is used only as a null indicator, the displacement being indicated by a pointer attached to a coil which can slide along an iron rod near the ends of which are fixed two coils of opposite polarity connected in series with the gauge primary circuits, the sliding coil being connected in series with the gauge secondaries and moving coil of the indicator. If the gauge armature be moved from its central position, an e.m.f. is set up displacing the indicator from zero. This e.m.f. may be balanced by the e.m.f. in the sliding coil caused by moving it from its central position so that the indicator is restored to zero. The pointer attached to the moving coil then indicates the displacement of the gauge armature on a very enlarged scale, which is closely linear. The sliding coil principle of this instrument has been adapted to make a recorder in which the sliding coil replaces the ordinary slide wire with the advantage of having no moving contacts. A.

531.717.98 : 535.312 *see Abstr.* 907

531.752 : 621.317.39 832

An electronic analytical balance. CLARK, J. W. *Rev. Sci. Instrum.*, **18**, 915–18 (*Dec.*, 1947).—The pan system hangs in space under the lifting action of an electromagnet, and a vane attached to it intercepts light falling on a photocell, the output of which is amplified and used to control the magnetic field, and also give a meter reading. The instrument is quick and easy to use, and is direct-reading. The sensitivity depends on the stability of the power supplies, 50 mg/mA being achieved in an experimental model. It should be possible to weigh to $\pm$ 1 μg.

531.787.2 : 621.317.39 8

An accurate pressure gauge employing measurement surface strain on diaphragms. GHOSH, J. C., SAST M. V. C., AND CHINNAPPA, K. V. *Curr. Sci.*, **16**, 274 (*Sept.*, 1947).—A thin diaphragm ($\sim$ 1/20 in thic machined from solid, was used, with a bonded-w strain gauge attached to its centre. Operation was lin without hysteresis, lag or creep, and max. pressu readable were > 1 000 lbs/in².

531.788.13 : 533.5 = 5 *see Abstr.* 854

MECHANICS OF LIQUIDS 532

532.122 : 539.89 : 535.324 *see Abstr.* 910

532.122 : 541.182 : 534.614 : 539.32.08 *see Abstr.* 1091

532.13 : 532.74 8

Viscosities of cis- and trans-1-2-dichloroethene, connection with Eyring's theory of viscous flow. KETELAA J. A. A., DE VRIES, L., VAN VELDEN, P. F., AND KOO J. S. *Rec. Trav. Chim. Pays. Bas.*, **66**, 733–45 (*De* 1947).—Using a modified form of the Ostwald visco meter, viscosity-measurements have been carried o over a temperature-range from the melting points up about 20°c for the two isomers of 1-2-dichloroether Density-measurements were made over the same ran of temperature. Special care has been taken in purifyi the samples used. From the data obtained, values of t free energy, the energy and the entropy of activati for viscous flow have been calculated, using Eyrin theory. It appears that the experimental quantity E_v defined by $E_{vis} = R\, d(\ln \eta)/d(1/T)$, has a temperatur independent value of about the same magnitude for bo isomers, whereas Eyring's "energy of activation f viscous flow" is temperature-dependent. It is conclud that both isomers behave as normal unassociated su stances, which conclusion is reached as well from co sideration of the values of the "rheochor" and from t relation between the surface tension and E_{vis}.

532.13 : 541.24 : 541.64 *see Abstr.* 1107

532.13.096 8

Some remarks on Eyring's theory of viscous flo VAN VELDEN, P. F. *Physica, 's Grav.*, **13**, 529–37 (*No* 1947).—It is concluded that the difference between t experimental quantity $E_{vis} = R\,.\,d(\ln \eta)/d(1/T)$ a Eyring's "energy of activation for viscous flow" (U cannot be neglected, as has been done in previous wor For many compounds, E_{vis} has been found to be i dependent of temperature over the ranges measured. appears to be impossible to explain this on the basis Eyring's theory.

532.137 8

End-effect in rotational viscometers. LINDSLEY, C. H AND FISCHER, E. K. *J. Appl. Phys.*, **18**, 988–96 (*No* 1947).—The variation of end-effect with the followi factors has been studied by the method of multiple bob (1) radius of bob; (2) clearance between cylindric surfaces; (3) separation between bottom of bob and cu and (4) viscosity. The magnitude of the end-effe increases with radius and with clearance. For separatio at the bottom > 1 cm and for viscosities > 1 poise t end-effect is nearly constant, but must be determined f each cup and bob combination. At lower viscosities t correction must be determined either by calibration wi a standard liquid of about the same viscosity as t unknown, or by the multiple-bob method. It is show that trapping a layer of air beneath the bob is not effecti in making the traction on the bottom negligible. T end-effect is almost as large for a bob with an ope bottom as for a closed one. When the method

ltiple bobs is used, data with an accuracy of ± 2% can obtained without calibration. When the instrument stant is determined with standard liquids or computed m a value for the end-effect previously found, data of newhat lower accuracy result, but the uncertainty uld be within ± 5%. A.

.137 : 541.18.025 837

nitial oscillation on a rotational viscometer. WELT-NN, R. N. *J. Appl. Phys.*, **18**, 933–40 (*Nov.*, 1947).—oscillatory system of a rotational viscometer has n investigated. The oscillation equations were cked with experimental bob deflection-time curves ained for Newtonian liquids. To be able to obtain rect values rapidly when taking flow curves the illatory system should be critically damped. Since condition cannot be easily obtained in practice, the tem should be slightly overdamped, meaning that the tia should be $\leqslant \pi\mu^2/720KS^2$. It is shown that due the higher viscosity of thixotropic materials at lower es of shear, the flow curves at these rates give an ication of rather too low than too high shearing sses. A.

.5 : 532.6 838

The "floating thread," a surface phenomenon on ving water. KUŠČER, I. *Nature, Lond.*, **160**, 673–4 ov. 15, 1947).—An explanation is given of the appear-ce of a small elevation, resembling a hair or thread, oss the surface of a slowly moving stream of water eral feet up stream from an obstacle placed across the am in its surface.

.516 : 539.23 839

nfluence of water on the lubrication of metals. TINGLE, D. *Nature, Lond.*, **160**, 710 (*Nov.* 22, 1947).—brication of freshly exposed metal surfaces (Cu, Cd, g) by fatty acids was found to be ineffective until the face has been in contact with water or water vapour d dried. This confirms the chemical character of achment of the lubricating layer [Abstr. 2783 (1945), 35 (1947)] and indicates that a loose hydroxide or drated oxide plays a part.

2.517.4 840

Reconsideration of the theory of free turbulence. UIRE, H. B. *Phil. Mag.*, **39**, 1–20 (*Jan.*, 1948).—mensional analysis is applied to various problems of turbulence, e.g. the wake of a symmetrical cylinder, a body of revolution, the plane and round jets, and a ke of a row of rods. No hypothesis about the nature turbulent flow is made. The various theories of rbulent flow are then discussed. These include the omentum transfer theory, the vorticity transfer theory, arman's similarity theory and Reichart's theory. The ort concludes with a note on wall turbulence: the duction of the logarithmic velocity distribution near a all. L. S. G.

2.52 841

A calculation of the viscous force exerted by a flowing id on a dense swarm of particles. BRINKMAN, H. C. *ppl. Sci. Res.*, **A1** (*No.* 1) 27–34 (1947).—The model derlying these calculations is that of a spherical rticle embedded in a porous mass. The flow through is porous mass is described by Darcy's equation, odified to obtain consistent boundary conditions. A lation between permeability and particle size and nsity is obtained. The results are compared with an perimental relation due to Carman. A.

2.57.08 : 621.317.39 842

An electric flow meter. LAUB, J. H. *Elect. Engng, N.Y.*, **66**, 1216–19 (*Dec.*, 1947).—An "electro-caloric" instrument for measuring fluid flow. A tube section with heater coil is inserted in the fluid pipe and thermally insulated by spacers. The temp. difference between two upstream and downstream resistance thermometers is automatically maintained constant by adjusting the power input to the heater coil. This is achieved by a null bridge circuit, an electronic amplifier and a motor-driven current regulator. Rate of fluid flow is then indicated on a wattmeter and quantity of flow on a Wh-meter. An additional resistance thermometer in the bridge circuit compensates for the variation of fluid sp. heat and viscosity with temp. For large quantities of fluid a by-pass arrangement is used. V. W. R.

532.59 : 551.465 843

Some observations of waves and other fluctuations in a tidal current. BOWDEN, K. F. *Proc. Roy. Soc. A*, **192**, 403–25 (*Feb.* 18, 1948).—Observations have been made of fluctuations in the speed of a tidal current with periods of about 2 sec upwards. At the same time pressure-gauge records were obtained, showing oscillations due to the wave motion. Both current and pressure measurements were made at various depths between the surface and the bottom. From the pressure records, the rate of attenuation of wave pressures with depth has been shown to follow the theoretical equation, within the limits set by the experimental conditions. The current variations have been classified into short-period and long-period fluctuations. The short-period fluctuations correspond approximately in period to the waves, and their amplitudes are of the same order of magnitude as the calculated wave-particle velocities. The correspondence is not complete, however, and, while it appears probable that the current fluctuations are largely due to the particle velocities of the waves, the possibility of other fluctuations of similar or shorter periods being present is not excluded. The periods of the long-period fluctuations vary from 30 sec to several minutes, and their amplitude, which increases with the mean current and with depth, sometimes attains 0·4 of the mean current. A.

532.596 : 621.3.025 844

Analogy between tides and a.c. electricity. I. VAN VEEN, J. *Engineer, Lond.*, **184**, 498–500 (*Nov.* 28, 1947).—Lorentz's mathematical treatment of the problem of tides in a network of channels, and its extension by Mazure, Stroband, the Research Bureau of the Rijkswaterstaat, and Dronkers are briefly referred to. In the latest development of the subject, the problem has been much simplified by the use of analogues between tidal motion and a.c. electricity. The analogues of conductance, resistance, potential, motive power, Ohm's law, Kirchoff laws, capacity, "vitality" factor are briefly discussed, and the theory is then applied to discuss the flare factor, propagation of tidal waves, and to construct actual electrical circuits analogous to practical tidal channels. J. S. G. T.

CAPILLARITY 532.6

532.6 : 532.5 *see Abstr.* 838

532.61 845

Variation of surface tension of solutions with time. DOSS, K. S. GURURAJA. *Curr. Sci.*, **16**, 370–3 (*Dec.*, 1947).—Current theories are reviewed. (Bibliography of 23 entries.)

KINETIC THEORY OF LIQUIDS 532.7

532.7 : 539.13 : 541.64 846

Mechanical degradation of large molecules. MORRIS, W. J., AND SCHNURMANN, R. *Nature, Lond.*, **160**, 674

(*Nov.* 15, 1947).—Results are reported of the rupturing of long-chain hydrocarbon molecules by subjecting them to repeated shear stresses, by passage through a narrow jet. A permanent viscosity loss was found, dependent exponentially on the number of cycles of passage through the jet, and a rise in the temp./viscosity coefficient. The results agree quantitatively with values calculated from the strength of the C–C single bond; the rupture forces ∝ (molecule length)^2 and are greatest for the centre bond. Materials of molecular weight down to 25 000 could be broken down.

532.712 ≏ 3 847

Statistical theory of macromolecular solutions. II. Entropy of mixture and osmotic pressure of solutions of elongated rigid particles. III. Elongated particles with inner mobility. SCHULZ, G. V. *Z. Naturforsch.*, **2a**, 348–57 (*June*); 411–19 (*July*, 1947) *In German.*—It is shown from statistical calculations that the entropy of mixtures, and therewith the osmotic pressure, in solutions of elongated particles, is considerably higher than in solutions of spherical particles [Abstr. 2549 (1947)]. The effect is found to be dependent entirely on the axis relationships of the particles, and the relevant mathematical equations are derived for a cylindrical model. Satisfactory agreement is found with some experimental data which have been obtained for axis relationships from sedimentation velocities in the ultra-centrifuge for molecules of serumglobulin and myosin; and from osmotic measurements. In Part III, the mixture entropy of solutions of fibre molecules with internal mobility has been derived by a molecular statistical method based on a molecular model. The latter is composed of a number of rigid members in a linear arrangement, each of which can move entirely independent of the others; and the greater the inner mobility of a fibre molecule, the more the number of members in the model. The calculation indicates that the entropy of mixture, and therewith the osmotic pressure, is greater than corresponds with the ideal law, and this enhancement has been determined from the ratio of the length to the cross-section of the single members of the model. Fibre molecules, with perfectly freely unhindered rotations, exhibit an ideal entropy of mixture, and their osmotic pressure obeys the van 't Hoff law, when their heats of dilution are zero. Only one example of experimental data is to be found in the literature, viz., of guttapercha in toluene, and here the results are in fairly good agreement with the calculations. For solutions with finite values of their heats of dilution (positive or negative), it is not possible as yet to gain information as to the shape of molecules from osmotic measurements. H. H. HO.

532.72 848

On a generalization in the diffusion theory. LAMM, O. *J. Phys. Coll. Chem.*, **51**, 1063–78 (*Sept.*, 1947).—The scope and features of a theory of diffusion, detailed in earlier works [Abstr. 1820, 2281, 2800–1, 3083 (1947)], are outlined. A simple proof of a generalized Sutherland–Einstein equation for the diffusion of a binary solution in general is given, and the interpretation of diffusion measurements discussed. The properties of the thermodynamic factor and the frictional coefficients involved are treated in some detail, considering the chemical equilibrium between the components in arbitrary or dilute solutions. An equation for the diffusion of electrolytes is computed. A note is added on the diffusion of a ternary solution. A.

532.72 849

A diffusion problem in which the amount of diffusing substance is finite. I. WILSON, A. H. *Phil. Mag.*, **39**, 48–58 (*Jan.*, 1948).—The problem arose in a study of the effects which occur in the commercial dye-bath. The effect of the finiteness of the dye-bath is treated exactly, i.e. without numerical methods, by taking the law of adsorption of the dye to be as simple as possible. Diffusion into a lamina or a circular cylinder is analysed and diffusion when the rate of adsorption is very rapid or when the rates of adsorption and diffusion are comparable are studied. Two methods are used, expansion in orthogonal functions and the Laplace transform. L. S. G.

532.72 : 535.417 85

A rapid method for determining diffusion constants in solution. COULSON, C. A., COX, J. T., OGSTON, A. G. AND PHILPOT, J. ST. L. *Proc. Roy. Soc. A*, **192**, 382–402 (*Feb.* 18, 1948).—A method has been rediscovered, and developed in theory and practice, for optical observation of the earliest stages of diffusion across an initially sharp boundary between a dilute solution and a solvent. It enables the diffusion constant of a monodisperse solute to be measured about 50 × as quickly as by other methods, at lower concentration and possibly with greater accuracy; it should therefore be particularly valuable for the study of high molecular substances. The method is based on the interference pattern which is formed when monochromatic light from a horizontal slit is focused after passing through a cell where diffusion is occurring. The pattern, a set of horizontal bands, contracts towards the optic axis as diffusion proceeds, at a rate from which the diffusion constant can be calculated. By counting the bands in the pattern the refractive increment of the solute can be determined. The sharp initial boundary is obtained by flowing the solution and solvent out through a common narrow horizontal slit. The construction, calibration, and use of the apparatus are described. A.

532.74 : 532.13 *see Abstr.* 834

532.74 : 536.222 *see Abstr.* 950

532.74 : 536.7 85

On the thermodynamics of non-electrolyte solutions and its technical applications. III. Systems with associated components. REDLICH, O., AND KISTER, A. T. *J. Chem. Phys.*, **15**, 849–55 (*Dec.*, 1947).—The influence of continuous association of one component on the free energy of a non-electrolyte solution is derived from a few assumptions. The result is in accord with available data for hydrocarbon-alcohol solutions. Systems of two associating components and the general interpretation of the free energy of non-electrolyte solutions are briefly discussed. A.

532.77 : 536.75 *see Abstr.* 958

532.782 85

An interesting case of water undercooling. MCCRACKEN, E. C. *Science*, **106**, 453 (*Nov.*, 1947).—Super-cooling of water was found to be a very common occurrence when cooled in cartons in a refrigerator. No special conditions of cleanliness were necessary, and mechanical vibration had apparently no effect on the phenomenon.

MECHANICS OF GASES 533

533.15 : 533.7 85

The self-diffusion coefficient of argon. HUTCHINSON, E. *Phys. Rev.*, **72**, 1256 (*Dec.* 15, 1947).—At 32 cm of Hg and 22°c the value is found to be $0{\cdot}432 \pm 0{\cdot}003$ cm^2/sec which, by assuming values for the viscosity and density, gives a value $\varepsilon = 1{\cdot}31 \pm 0{\cdot}01$ for the collision constant in disagreement with the value deduced by Chapman and Cowling. W. E. I.

3.21 : 534.222.2 *see Abstr.* 865

3.275 : 536.242 : 545.7 *see Abstr.* 1109

3.5 : 531.788.13 = 5 854

Compensating radiometric vacuum meter. ROSTAGNI, A. AND FILOSOFO, I. *Nuovo Cim.*, **4**, 74–84 (*Feb.*, 1947) *Italian.*—The meter is described in Abstr. 2783 (1947). The behaviour with different gases is here reported, and curves are given. A pressure of maximum sensitivity exists for each gas, which (as also the max. sensitivity itself) approx. $\propto$ the mean free path at N.T.P. in the gas. At low pressures all the gases behave similarly, small differences (and a hysteresis exhibited by H_2) being due to accommodation coefficients and adsorption of the molecules on the walls. A.

3.52 : 536.423.4 : 545.7 *see Abstr.* 1110

KINETIC THEORY OF GASES 533.7

7.7 : 533.15 *see Abstr.* 853

3.7 : 535.338.334 : 535.343.4–14 *see Abstr.* 923

3.7 : 536.782 855

The second virial coefficient of a gas of non-spherical molecules. CORNER, J. *Proc. Roy. Soc. A*, **192**, 275–92 (*Feb.* 4, 1948).—Tables are given for the second virial coefficient and Joule-Thomson coefficient (at low pressures) of a gas whose molecules are non-polar, approximately cylindrical, and stiff. The tables cover a range of length/breadth ratio consistent with the last assumption. They can be used for the analysis of observed virial coefficients of gases whose molecules satisfy these assumptions, and give an estimate of the intermolecular forces between these molecules at any relative orientation. For small ratio of length to breadth the virial coefficient $\simeq$ that of a spherical molecule with certain mean values of the parameters defining the intermolecular field. This makes it possible to relate these mean parameters to the critical constants and to the parachor. The virial coefficients of 9 gases are analysed. The data on 7 hydrocarbons enable one to estimate the law of force between molecules of the lower non-polar hydrocarbons. A.

3.7 : 539.13 = 5 856

On molecular forces. CRINÒ, B. R. *Nuovo Cim.*, **3**, 401–411 (*Dec.*, 1946) *In Italian.*—The object of the present work is to find an analytical expression for the potential of the intermolecular forces, taking as a starting point Amagat's experimental data on carbon dioxide. The potential is defined by the equation $L = RT - PV$ and is found to consist of two parts: $L = L_\alpha - L_\beta$ where $L_\alpha = e^{-ar+b}$ is the potential of attractive forces and $L_\beta = kr^{-n}$ is the potential of repulsive forces. The analytical expression of the curve connecting the points marking the start and the end of liquefaction in the L, r diagram (corresponding to the bell-shaped curve in the P, V diagram) is given by $e^{-0\cdot271r+11\cdot265} - 0\cdot834 \times 10^{-70r-10}$ where the second term is negligible for part of the curve connecting the points of the beginning of liquefaction. A.

VIBRATIONS . ACOUSTICS 534

4.01 857

Stability and high frequency. WINTNER, A. *J. Appl. Phys.*, **18**, 941–2 (*Nov.*, 1947).—In a linear oscillator which is not conservative, let the frequency vary so as $\to \infty$ when time increases indefinitely. It seems to be evident that the oscillations must then be of stable type. Actually, this is not true. The paradox results from the circumstance that the relevant criterion of stability depends on the monotone decrease, rather than on the indefinite decrease, of the instantaneous period. A.

534.01 : 531.383 *see Abstr.* 830

534.01 : 621.3.018 858

Solid diagrams illustrating resonance phenomena. PROWSE, W. A. *Proc. Phys. Soc., Lond.*, **60**, 142–4 (*Feb.*, 1948).—Three-dimensional vector loci are used to express the properties of resonant circuits and of the tuned transformer. An indication is given of the application of the method to other problems, including a simple low frequency selector circuit. A.

534.01 : 621.3.018 = 4 859

Oscillations and transitory phenomena. Their study by means of the Laplace and Cauchy transforms. BOUTHILLON, L. *Ann. Radioélectricité*, **2**, 287–328 (*Oct.*, 1947) *In French.*—The phenomena occurring in mechanical and linear electrical systems are discussed, the various differential equations that arise being classified. These include the telegraphic equation, the equation of diffusion and the wave equation. The method of the Laplace and Cauchy transforms for solving these equations and a table of Laplace transforms are given. L. S. G.

534.113 : 534.37 : 539.32.08 = 5 *see Abstr.* 1092

534.121.1 : 534.3 860

Plate vibration of stringed instruments at the wolfnote. KESSLER, J. A. *J. Acoust. Soc. Amer.*, **19**, 886–91 (*Sept.*, 1947).—The principal mode of belly vibration at the wolfnote was determined by direct investigation of violins, violas, and cellos. The same mode was found to be common to all three types of instrument, corresponding to a marked peak in the response curves of the instruments. Chladni sand patterns were obtained on a flat brass plate shaped like a violin; typical patterns are presented, including the mode observed on instruments at the wolfnote. Requirements and methods for improving the wolfnote are discussed. Some functions of the *f*-holes, soundpost, bass-bar, and sides are noted. A.

534.2 : 534.231.3 = 5 861

Determination of the parameters of sound propagation in absorbing bodies. FERRERO, M., AND SACERDOTE, G. *Nuovo Cim.*, **4**, 262–74 (*Oct.*, 1947) *In Italian.*—It is possible to determine the parameters of propagation from measurements of acoustical impedance of homogeneous absorbent materials made with the method of stationary waves. Measurements are made with two thicknesses of materials, one double the other. The material behaves like an electrical quadripole, but in the case of sound propagation the characteristic primary parameters vary with the frequency. An example is given of the method proposed and the parameters are calculated for mineral wool. A.

534.213 : 535.43 *see Abstr.* 938

534.22 : 536.48 862

Erratum: Second sound in liquid helium II. LANE, C. T., FAIRBANK, H. A., AND FAIRBANK, W. M. *Phys. Rev.*, **72**, 1129 (*Dec.* 1, 1947).—[Abstr. 1759 (1947).]

534.222 : 551.524.7 863

Microbarometric pressures from large high explosive blasts. COX, E. F. *J. Acoust. Soc. Amer.*, **19**, 832–46 (*Sept.*, 1947).—Detonated charges produced pressure waves recorded by subsonic frequency microbarographs at distances 12·9 to 452 km. Observations showed both normal and abnormal signals at 182 and 292 km, no clear abnormal signals at 141 or 89 km, no signals of any kind at 872 km. In the zone of normal audibility, average wave velocity between blast point and receiving station decreases slightly with increasing distance, and may increase slightly with charge weight; it is sub-

stantially the same as sound velocity. No consistent travel-time differences for the abnormal signals resulted from changing charge weight between 3·2 and 250 tons TNT. Neither normal nor abnormal signal strengths were predictable from charge weight. The largest abnormal signal properly recorded was a 3-cycle wave train with peak-to-peak amplitude 220 microbars received 182 km from a 125-ton blast. Interpolated to apex pressure perturbation, this signal amplitude eliminates shock wave supersonic velocity as a logical explanation for abnormal audibility. Incident angles of abnormal rays are not calculable. However, if one assumes 182 km as the descent distance for rays starting out horizontally, neglects wind effects, and accepts the apex temperatures measured by balloons, rough calculations of lower stratosphere temperatures are possible. These establish 34 km as a minimum altitude at which ground temperature is reached. A.

534.222.2 864

Mach waves in shock wave systems from detonating explosives. WOODHEAD, D. W., AND WILSON, R. *Nature, Lond.*, **160**, 672–3 (*Nov.* 15, 1947).—Schlieren photographs have been taken with a rotating mirror camera which show Mach waves originating in the intersection at obtuse angles of two shock waves, one from the sides and the other from the end of a cylindrical charge. The Mach waves traverse an annular cone or funnel, but the shape and disposition depend on the shape of the charge.

534.222.2 : 533.21 865

The compression of a gas by a rigid piston moving in a closed rigid tube. PATERSON, S. *Phil. Mag.*, **39**, 76–82 (*Jan.*, 1948).—The piston moves inward instantaneously from rest with a constant velocity, U. A shock wave passes through the gas, is reflected at the closed end and then at the piston, so giving rise to a succession of shock waves. Expressions are obtained for the velocities and pressures of these waves, when U is not assumed to be small compared with the velocity of sound. The ordinary adiabatic law, $pv^{\gamma} = \text{const.}$, is closely followed, if the ratio of U to the initial pressure is small, but not otherwise. L. S. G.

534.222.2 : 541.126 866

The propagation of shock waves in steel and lead. PACK, D. C., EVANS, W. M., AND JAMES, H. J. *Proc. Phys. Soc., Lond.*, **60**, 1–8 (*Jan.*, 1948).—An investigation is made of the stress system set up by an explosive detonating in contact with a metal surface. An extrapolation from data on the compressibility of steel and Pb leads to the conclusion that the shock wave set up by the detonation has an initial velocity in steel $<$, and an initial velocity in Pb $>$, than the velocity of plane elastic waves. The time taken by the fastest pulse to penetrate various lengths of steel and of Pb has been measured experimentally, and the results confirm that the plane elastic waves move more quickly for steel; while for Pb the shock wave before damping has a velocity well in excess of that of the elastic waves. A.

534.23/.24 867

Reflection and transmission of sound by thin curved shells. PRIMAKOFF, H., AND KELLER, J. B. *J. Acoust. Soc. Amer.*, **19**, 820–31 (*Sept.*, 1947).—The reflection and transmission coefficients of the shell are obtained mathematically. The reflection coefficient can be expressed as the product of a geometrical factor, a phase-cancellation factor, and a reflectivity factor. When the reflection problem for a rigid obstacle is solved with the aid of the assumptions of the Kirchhoff diffraction theory, the reflection coefficient thus obtained is the product of the geometrical and phase factors of the previous solution. The geometrical factor alone obtained as the reflection coefficient when the reflectio problem is solved exactly by geometrical acoustics. Th agreement among the various solutions may be considere as a partial justification for the Kirchhoff theory as we as for geometrical acoustics. The Kirchhoff method also applied to the problem of refraction at a curve surface. From the solutions of the reflection an refraction problems, the laws of reflection and refractio for curved surfaces are obtained. In addition, the mirr and lens laws, the conditions for point images, and th change of phase at a focus are obtained.

534.231.3 8

A continuously variable acoustic impedance. WHIT J. E. *J. Acoust. Soc. Amer.*, **19**, 846–9 (*Sept.*, 1947).— The mechanical impedance of an electromagnet speaker is affected by current flowing in the electric elements, just as the electrical impedance is influenc by the motion of the mechanical system. This paper giv the relation between mechanical impedance and electric load impedance, making use of the 3 complex speak constants evaluated by the motional impedance meth presented earlier by Fay [Abstr. 2521 B (1943)] Measurements are given showing that the mechanic impedance of a WE555 horn driver can be varied over fairly wide range.

534.231.3 8

Measurement of acoustic impedances of surfaces in wate FAY, R. D., BROWN, R. L., AND FORTIER, O. V. *J. Acous Soc. Amer.*, **19**, 850–6 (*Sept.*, 1947).—An analytical an experimental investigation of the practicability of a wate filled acoustic impedance tube, for measuring the in pedance of underwater acoustic materials, is describe The phase velocity of sound in the tube is nearly consta in the useful frequency range but $<$ the velocity of soun in free water, and the variation in sound pressure along radius of the tube is frequency-dependent. Bo rigorous and approximate formulae are given for th phase velocity and radial pressure dependence. The formulae are checked experimentally.

534.231.3 : 534.2 = 5 *see Abstr.* 861

534.231.3 : 534.24 = 3 *see Abstr.* 875

534.231.3 : 534.845.1 *see Abstr.* 902

534.231.3 : 621.392.51 : 621.3.011 87

Coordinates and the reciprocity theorem in electr mechanical systems. MILES, J. W. *J. Acoust. Soc. Amer* **19**, 910–13 (*Sept.*, 1947).—It is shown that the (forc voltage, velocity-current) mechanical-electrical analog yields circuit equations for an electrostatic electr mechanical transducer which satisfy the reciprocit theorem, while the (force-current, velocity-voltag analogy acts similarly for a magnetic transduce Reversing the two analogies between the two types transducers yields (in both cases) equations which violat the reciprocity theorem in sign but not in magnitud These conclusions indicate proper co-ordinate choices applying Lagrange's equations to such systems. It is als shown that McMillan's "one-way" four-terminal ne work [Abstr. 253, 2803–4 (1947)] is equivalent to a simpl class A vacuum-tube amplifier having an amplificatio factor of ~ 2.

534.231.3 : 621.392.51 : 621.3.011.1 87

Further remarks on reciprocity. MCMILLAN, E. M *J. Acoust. Soc. Amer.*, **19**, 922 (*Sept.*, 1947).—[See Abst 2803–4 (1947)].

534.232 87

A powerful high frequency siren. ALLEN, C. H., AN RUDNICK, I. *J. Acoust. Soc. Amer.*, **19**, 857–65 (*Sept*

').—Design construction and performance are ribed. The 6 in rotor is driven by a ¾ h.p. motor. n chamber pressure ~0·2 atmos., the measured iency was 17–34% in the range 3–19 kc/s, with stic output 84–176 W. With pressure ~2 atmos., V output was obtained, at 20% efficiency. Some ing phenomena occurring in the intense sound field tuced are described. A.

232 873

ones as underwater transducer reflectors. MUESER, E. *J. Acoust. Soc. Amer.*, **19**, 952–5 (*Nov.*, 1947).— conical reflectors have been constructed and used in unction with complete 90° cones. The result is a ctional transducer in place of the non-directional ake pattern resulting from a line source radiator str. 1769 (1947)]. The change in peak sensitivity by sing the beam is approximately equivalent to the ge in directivity index. A.

232 : 534.612.4 874

elf-reciprocity calibration of electroacoustic trans-ers. CARSTENSEN, E. L. *J. Acoust. Soc. Amer.*, **19**, -5 (*Nov.*, 1947).—Full treatment [see Abstr. 268 8)]. Measurements using the technique are described shown to give satisfactory agreement with con-tional calibrations. A.

232 : 534.612.4 *see Abstr.* 883

24 : 534.231.3 = 5 875

oefficient of reflection and acoustic impedance. RERO, M., AND SACERDOTE, G. *Nuovo Cim.*, **4**, -45 (*June*, 1947) *In Italian.*—From the knowledge of reflection coefficient of an acoustic material, it is sible to determine the components of the acoustic edance. A numerical example of this determination iven. A.

3 : 534.121.1 *see Abstr.* 860

321.3 : 518.5 876

slide rule for the study of music and musical acoustics. DDINGTON, L. E. *J. Acoust. Soc. Amer.*, **19**, 878–85 t., 1947).—The rule adjusts relative vibration rates, rees of scale, intervals, chord structures, scale indica-s, and transposition data, against a base of the piano board. It employs and relates several standard systems requency level specification. A.

321.9 : 534.614 *see Abstr.* 884

321.9 : 534.62 *see Abstr.* 888

321.9 : 534.845 877

bsorption of ultrasonic waves in liquids. *Nature*, *d.*, **160**, 913–14 (*Dec.* 27, 1947).—A brief account of discussion meeting of the Physical Society, devoted inly to experimental observations.

321.9 : 536.48 : 534.614 *see Abstr.* 885

321.9 : 620.179.16 878

Design of an ultrasonic analyzer. *Electronics*, **20**, 45 (*Dec.*, 1947).—[Abstr. 802 B (1948)].

322 879

The performance of cup-mouthpiece instruments. LONG, H. *J. Acoust. Soc. Amer.*, **19**, 892–901 (*Sept.*, 1947).— s shown by a qualitative analysis that the playing of -mouthpiece instruments must be associated with the stence of a pressure antinode at or near the mouth-ce, and that harmonic production in such instruments be adequately explained by the acoustic overload in air column. A quantitative analysis discloses the echanism" by which the odd series of modes of ration occur at frequencies related to each other by 1, 2, 3, 4 integers of the complete harmonic series. A.

534.322 880

An electrical method of measuring the intonation of cup-mouthpiece instruments. WEBSTER, J. C. *J. Acoust. Soc. Amer.*, **19**, 902–6 (*Sept.*, 1947).—An electrical driving system has been worked out for intonation tests on cup mouthpiece instruments. The system amounts to driving an acoustic transmission line from a closed end and measuring the resonant frequencies. It is shown experimentally that these resonant frequencies correspond quite precisely to the frequencies normally played, except at the lower end of the scale where the player habitually corrects the defective intonation of the usual instrument. The experimental work includes tests on specially designed instruments that could not be played "in tune" with standard fingering. A.

534.37 : 534.113 : 539.32.08 = 5 *see Abstr.* 1092

534.37 : 539.31 *see Abstr.* 1086

534.372 : 539.32 : 621–752 : 534.833 *see Abstr.* 896

534.41 : 534.784 *see Abstr.* 895

534.414 : 534.845 *see Abstr.* 900

534.6 881

Underwater acoustical measuring facilities at the U.S. Navy Underwater Sound Laboratory. HILL, A. M. *J. Acoust. Soc. Amer.*, **19**, 907–9 (*Sept.*, 1947).

534.61 882

A recorder of difference of level. LAWTHER, J. M., AND KING, J. G. *J. Acoust. Soc. Amer.*, **19**, 966–70 (*Nov.*, 1947).—Modifications have been made on a level recorder to permit the measurement of difference in level between two sounds. The modified circuit is explained with simplified diagrams; anti-hunting devices are briefly noted; and the methods of pre-setting the instrument for level and differential operation are discussed. A.

534.612.4 : 534.232 883

The calibration of hydrophones and crystal transceivers. ASTBURY, N. F. *Proc. Phys. Soc., Lond.*, **60**, 193–204 (*Feb.*, 1948).—A scheme of measurements is discussed from which absolute determinations of sound field pressure can be made. The relation between the scheme and the reciprocity method is discussed. It is shown that the measurements also yield the axial pressure and "projection efficiency" of a transceiver, the "projection efficiency" being defined as the ratio of the actual axial intensity to the axial intensity as it would be if the transceiver converted the whole energy absorbed into sound by vibrating as a simple piston. It is suggested, without proof, that the upper limit of the projection efficiency is unity, and the relation between this quantity and the efficiency defined as the ratio of radiated acoustic power to consumed electrical power is shown to depend on a directivity coefficient and on the effective area of the radiator face. It is pointed out that neither of these quantities is readily determinable and that therefore the conversion efficiency of the transceiver, and hence the acoustic power radiated, cannot be obtained. A.

534.612.4 : 534.232 *see Abstr.* 874

534.614 : 534.321.9 884

A precision ultrasonic interferometer for liquids and some velocities in heavy water. MCMILLAN, D. R., JR., AND LAGEMANN, R. T. *J. Acovst. Soc. Amer.*, **19**, 956–60 (*Nov.*, 1947).—An acoustic interferometer of improved design and the associated electronic circuit for measurement of ultrasonic velocities in liquids are described. A beat-frequency oscillator is used to generate the ultrasonic waves in the liquid, and a vacuum-tube voltmeter is employed as a detector of nodal positions. In order to secure adequate stability an electronically stabilized power supply is used. Measurements of velocities in acetone,

benzene and distilled water are compared with those of earlier workers, and new measurements for heavy water at 5°, 10° and 15°c are tabulated. A.

534.614 : 534.321.9 : 536.48 885

Ultrasonic velocity and absorption in liquid helium. Pellam, J. R., and Squire, C. F. *Phys. Rev.*, **72**, 1245–52 (*Dec.* 15, 1947).—Measurements are given as a function of temperature from 1·57°K to 4·5°K. The velocity at 15 Mc/s was found to agree with results obtained at 1·3 Mc/s by previous investigators, and hence there is no dispersion in this frequency range. The attenuation measurements exhibit three important features: (*a*) in the upper temperature range of He I the measurements agree very well with classical theory; (*b*) at the λ-point the attenuation coefficient rises abruptly, presumably to ∞, indicating complete absorption of the ultrasonic energy; (*c*) just below the λ-point the attenuation (first sound in He II) has its smallest value and with lowering temperature the attenuation increases. A.

534.614 : 541.182 : 532.122 : 539.32.08 *see Abstr.* 1091

534.62 886

Construction and design of Parmly Sound Laboratory and anechoic chamber. Mills, P. J. *J. Acoust. Soc. Amer.*, **19**, 988–92 (*Nov.*, 1947).—The chief feature of the laboratory is an echo free or "anechoic" chamber. The 40-ton chamber of concrete, steel, wood and sheet-rock construction is suspended on Neoprene pads to have a natural frequency of $\sim 4\frac{1}{2}$ c/s. Continuous ventilation through ducts of high sound attenuation, 90 db at 128 c/s, is provided. The inner surfaces are designed to have 99% absorption or better at 115 c/s or above. The Harvard treatment of wedge-shaped Fiberglas is used. The chamber is housed in a concrete block wing, the walls of which are lined with Fiberglas sheets. Costs in terms of man-hours are given. A.

534.62 887

Performance of the anechoic room of the Parmly Sound Laboratory. Hardy, H. C., Tyzzer, F. G., and Hall, H. H. *J. Acoust. Soc. Amer.*, **19**, 992–5 (*Nov.*, 1947).—The performance has been measured to determine the characteristics of rooms of small volume with wedge-covered walls. The inverse square law holds to within $\pm$ 1 db to 6·5 ft from 60 to 24 000 c/s, although the theoretical cut-off frequency of the room is 115 c/s. At 100 c/s, the radiation resistance of a loudspeaker placed near the walls was found to be 18% > the free-field value, and the radiation reactance was $\sim 5\%$ > the free-field value. The differences disappeared 2 ft from the wall. The wall transmission has been measured as a function of frequency, and the wedges themselves are found to act similarly to a thin plate in optics, having a maximum transmission at 110 c/s. A.

534.62 : 534.321.9 888

High frequency absorption in air and other gases. Sivian, L. J. *J. Acoust. Soc. Amer.*, **19**, 914–16 (*Sept.*, 1947).—The absorption coefficients were measured for gases: (*a*) O_2; (*b*) N_2; (*c*) $O_2 + N_2$ in normal air proportions; (*d*) $O_2 + N_2 + CO_2$ in normal air proportions; (*e*) $O_2 + N_2 + CO_2$ in normal air proportions, plus H_2O vapour at 37% r.h. at 26·5°c; (*f*) $O_2 + N_2$ in normal air proportions, plus a CO_2-content varied from zero to 1·15% by volume. Let R denote the ratio of the measured absorption coefficient to that computed from the Stokes–Kirchhoff equation. For gases (*a*), (*b*), (*c*) and (*d*), $R \simeq 1{\cdot}5$. For gas (*e*), $R \simeq 10$ at 15 kc/s, and approaches 1·5 with increasing frequency. For gas (*f*) at 89 kc/s, R increases with rising CO_2-content, attaining $\sim R = 20$ at 1·15% CO_2-content. A.

534.642

A short-tube method for measurement of impedar Cook, R. K. *J. Acoust. Soc. Amer.*, **19**, 922–3 (*Se* 1947).—Calculations have been made which show t the measurement of impedance of a material covering end of a short tube excited by a vibrating diaphra should be possible from measurements of absolute sou pressure in the tube. There would be several advanta over the usual long tube.

534.75 : 612.85 8

Phase effects in monaural perception. Mathes, R. and Miller, R. L. *J. Acoust. Soc. Amer.*, **19**, 780 (*Sept.*, 1947).—Experiments are reported demonstrat that the envelope-wave shape of a complex steady-st tone is an important factor in audible perception. particular, it strikingly influences sensations of roughn or smoothness and is related to a sensation of appar pitch. As envelope-wave shape depends on the pha as well as the amplitudes of the components, th differences of sensation can be produced by changes in phase alone of but a single component or group of co ponents. The results provide general verification o limitation placed by Helmholtz, on theoretical groun as to the degree to which his phase rule might be expect to be true. The experiments were conducted at su levels that subjective tones produced by non-linearity the ear are not believed to influence the results. It suggested that these results emphasize the importance time factors in the phenomena of aural perception.

534.75 : 612.85 8

Masking effect of periodically pulsed tones as a functi of time and frequency. Miller, R. L. *J. Acoust. S Amer.*, **19**, 798–807 (*Sept.*, 1947).—Studies have be made of the masking effect upon a similar wave of t same or different tone. The occurrence in relative ti of the masked wave was varied over the whole period pulse repetition. The masking is greatest when the t pulses are near coincidence, and approaches threshold the pulse separation becomes greater. A small amount fatigue effect was noticed when the masked pulse was the region following the masking pulse. A tota unexpected result was that the max. masking was genera obtained when the masked pulse preceded the maski pulse by 1 or 2 msec. The amount of this time differen was found to be independent of the pulse repetition ra in the region explored of 30 to 100 pulses/sec, but is function of the relative frequencies under the pu envelopes.

534.75 : 612.85 8

The effect of frequency spectrum on temporal integrati of energy in the ear. Garner, W. R. *J. Acoust. S Amer.*, **19**, 808–15 (*Sept.*, 1947).—Experiments were ma to determine whether the temporal integration threshold) depends on the frequency band of the ener to be integrated. The total energy in a short to $\propto$ duration, but the frequency band-width increases the duration decreases. The results indicated that as t duration decreased the threshold intensity had to increased > proportionately. The width of the ba necessary for max. integration is also related to frequen and the width of critical bands.

534.75 : 612.85 8

Studies on pitch discrimination in masking. II. T effect of signal/noise differential. Harris, J. D. *J. Acou Soc. Amer.*, **19**, 816–19 (*Sept.*, 1947).—The pitch d crimination of 30 observers was measured for a 1 000 tone under 4 levels of meshing noise. A discriminati of $\sim$ 10 c/s was present even when the tone itself cou hardly be detected.

.773 894

he influence of body-baffle effects on the performance earing aids. NICHOLS, R. H., JR., MARQUIS, R. J., KLUND, W. G., FILLER, A. S., HUDGINS, C. V., AND ERSON, G. E. *J. Acoust. Soc. Amer.*, **19**, 943–51 ., 1947).—The effect of the wearer's person as an ustic baffle on the response of a hearing aid, under -field and diffuse-field conditions, has been studied h a number of hearing aids and wearers. A charac- stic effect is found for each model of hearing aid when s worn at centre-chest position in free field. The racter of the effect does not appear to be strongly related with the size and shape of the wearer. In a nd field of "random" direction of incidence, the body- fle effect appears to be negligible. Within the limits of ar amplification of a hearing aid, one of the most nounced of the body-baffle effects had little or no uence on the intelligibility of speech, as determined h 4 subjects. A.

4.781 : 621.317.757 : 517.212.2 : 518.5 *see Abstr.* 802

4.784 : 534.41 895

Methods of measuring speech spectra. STEVENS, S. S., AN, J. P., AND MILLER, G. A. *J. Acoust. Soc. Amer.*, 771–80 (*Sept.*, 1947).—Several alternative methods are alysed, and a general procedure outlined, in which the known sound is compared with a suitable reference ctrum (preferably "white noise") whose composition known; only the microphone need then be calibrated. s most convenient to separate the spectrum into bands ich stimulate equally wide regions on the basilar mbrane. Very narrow bands (5 c/s) reveal detail not closed by wider bands. A.

4.833 : 534.372 : 539.32 : 621–752 896

The properties of felt in the reduction of noise and ration. TYZZER, F. G., AND HARDY, H. C. *J. Acoust. c. Amer.*, **19**, 872–7 (*Sept.*, 1947).—The dynamic ffness and damping of 3 widely different grades of felt re measured by means of resonance curves. The namic stiffness, which was much greater than the static ffness, decreased with amplitude so that the resonance rves were unsymmetrical. Except for pressures 6 lb/in², the stiffness modulus of felt increased with tic pressure at a rate which made their ratio nearly nstant. The natural frequency of a mass supported by felt pad is, therefore, nearly independent of the static essure load on the felt. Curves are given showing tural frequencies for 1-in thicknesses of soft, medium, d hard felt for a range of static pressure between 1·5 d 100 lb/in². It is shown that, except at low pressures, ere is little difference in the natural frequency of hard soft felt, and that there is a low limit of about 20 c/s r 1-in felt. A.

4.833.1 897

The measuring of impact sound transmission through ors. INGERSLEV, F., NIELSEN, A. K., AND LARSEN, S. F. *Acoust. Soc. Amer.*, **19**, 981–7 (*Nov.*, 1947).—A new ndard method of specification is suggested and dis- ssed, based on comparison of the sound transmitted rough the floor under investigation with that through standard floor. It is shown that the results may be fected by the material and design of the tapping-machine mmers, and the information obtained by a frequency alysis of the sound is pointed out.

4.845 898

Sound absorption by porous materials. I. V. D. EIJK, J., OSTEN, C. W., AND KOK, W. *Appl. Sci. Res.*, **B1** (*No.* 1) 50–62 (1947).—It is well known that, in order to obtain maximum absorption, sound-absorbing materials must not be fastened directly to the structural wall or ceiling, but must be kept at a certain distance, small in practice, from the wall or the ceiling. After describing a new interferometer, some results concerning the influence of the thickness of the layer of air between material and wall are given. These results are discussed and explained theoretically. Most remarkable is the large influence of very thin layers of air on the frequency at which a maximum absorption is obtained. A.

534.845 899

On the design of perforated facings for acoustic materials. BOLT, R. H. *J. Acoust. Soc. Amer.*, **19**, 917–21 (*Sept.*, 1947).—An approximate analysis of the acoustic behaviour of perforated facings for absorptive materials is outlined and is reduced to a design chart. Only the mass reactances of the holes and of the facing material are included in the analysis. This simplified picture is adequate for many practical problems, but breaks down for certain conditions which are discussed. If the acoustic impedance of the unfaced material is known, absorption coefficients for the material with perforated facing can be read directly from the chart. A.

534.845 : 534.321.9 *see Abstr.* 877

534.845 : 534.414 900

The application of Helmholtz resonators to sound-absorbing structures. JORDAN, V. L. *J. Acoust. Soc. Amer.*, **19**, 972–80 (*Nov.*, 1947).—This paper discusses structures whose absorption is primarily due to resonance phenomena similar to that occurring in Helmholtz resonators. The theory is developed here only for the simple case of a single resonator. Special attention has been given to the question of the resistance of the resonator. It is pointed out that the formula commonly used for the resistance of an aperture is not applicable in the case of resonance absorption, the actual values of the resistance being 3–6× > the calculation predicts in the cases considered. Some examples of the practical applications of resonance-absorbing structures are mentioned. A.

534.845 : 539.217.5 901

Flow-resistance characteristics of fibrous acoustical materials. NICHOLS, R. H., JR. *J. Acoust. Soc. Amer.*, **19**, 866–71 (*Sept.*, 1947).—From an experimental study of a large number of fibrous acoustical materials, the following empirical relation has been established for materials of high porosity (0·9 to 1·0): Flow resistance, $R = KS^{(1+x)}/T^x r^2$. (K = constant, characteristic of a particular material, S = surface density of the blanket of material, T = thickness, and r = cross-sectional radius of the fibres.) The type of construction of the material determines the value of x in the exponents. This value generally lies in the range from 0·3 to 1·0. A.

534.845.1 : 534.231.3 902

A new method for measuring sound absorption. KOSTEN, C. W. *Appl. Sci. Res.*, **B1** (*No.* 1) 35–49 (1947).—The electric impedance of a loudspeaker depends upon the acoustical load and may be used for measuring this load. The relation between the electric impedance of an electrodynamic loudspeaker and the acoustic impedance in front of the loudspeaker is given and discussed in detail. The consequences of the flexibility of the cone are studied. Simple formulae and graphs are given, connecting the electrical behaviour and the absorption coefficient corresponding to the load on the loudspeaker. The method seems to permit absorption measurements at low frequencies (50–500 c/s). A.

OPTICS . RADIATION . SPECTRA 535

535.14.08 : 537.542 = 4 *see Abstr.* 984

535.2 : 539.15 : 535.35 *see Abstr.* 929

535.23.08 903

The ultimate sensitivity of radiation detectors. JONES, R. C. *J. Opt. Soc. Amer.*, **37**, 879–90 (*Nov.*, 1947).—An upper limit is obtained for the sensitivity of any radiation detector which satisfies Lambert's law and whose effective area is independent of the wavelength of the radiation. The treatment given is based on thermodynamics, and makes no use of statistical mechanics. In the special case in which the fluctuations in the output of the detector are due entirely to fluctuations in the radiation, the results obtained agree with those obtained from a statistical mechanical treatment of the fluctuations in the radiation. The treatment is first confined to detectors which operate by means of the change in their temperature brought about by the radiation (e.g. thermocouple, bolometer, radiometer). It is shown that the results hold for any detector satisfying the conditions given above, provided that the emissivities are interpreted as quantum efficiencies. If the Lambert's law condition is given up, then there exists no lower limit on the minimum detectable power. Numerical examples and a comparison with the reported sensitivities of bolometers are given. A.

535.231.4 : 535.343–15 904

Comparison of glower and globar sources for infra-red spectrometry. FRIEDEL, R. A., AND SHARKEY, A. G., JR. *Rev. Sci. Instrum.*, **18**, 928 (*Dec.*, 1947).—The energy distributions between 1 and 15 μ of the two types of source were measured with a rock-salt prism spectrometer, and are shown in a graph. The glower (Nernst type) is very much superior.

535.242 : 535.371.07 905

Visual photometer for after-glow tests on cathode-ray tube screens. WHITE, W. G. *J. Sci. Instrum. Phys. Ind.*, **25**, 1–3 (*Jan.*, 1948).—The method employed is to measure with a stop-watch the time taken for screen brightness to decay from one level to another. A novel arrangement of a swinging neutral filter ensures the same level of brightness for initial and final balance. Convenience and simplicity were considered more important than accuracy, but the coefficient of variation of readings $\simeq 16\%$. A.

535.245 : 535.8 *see Abstr.* 947

535.247.4–31 : 614.485 906

New meters for germicidal energy. TAYLOR, A. H., AND HAYNES, H. *Gen. Elect. Rev.*, **50**, 27–9 (*Oct.*, 1947).—It is known that ultraviolet radiation has a considerable germicidal effect, and u.v. lamps have found practical application for this purpose. Reliable instruments are required to determine the intensity of such radiation and the amount of reflection from walls and ceilings. A reflectometer, an intensity meter and a "germicidal wattmeter" are described. They contain standard sources of u.v. light, photo-electric cells of known spectral sensitivity and suitable filters. Visible radiation is filtered out as much as possible. The equipments are battery-operated and portable. H. K. H.

535.312 : 531.717.88 907

An optical method of setting two opposed and opaque mirrors parallel. PERFECT, D. S. *J. Sci. Instrum. Phys. Ind.*, **25**, 15 (*Jan.*, 1948).—An inclined partially reflecting plate introduced between the mirrors divides a collimated beam into two components both of which ultimately enter a viewing telescope. One is simply transmitted by the plate, the other is reflected successively by the two mirrors. The necessary and sufficient condition for parallelism of mirrors is coincidence of the two image of the pinhole source. A criterion is given for adjustin within a given tolerance. Advantages of this metho over methods using auto-collimation are discussed.

535.321 : 535.39 : 535.514.2 90

Tables for the determination of the refractive index an of the thickness of the thin film by the polarimetric metho VAŠIČEK, A. *J. Opt. Soc. Amer.*, **37**, 979–80 (*Dec* 1947).—Tables for use with the author's method [Abst 1808 (1947)] are provided for films of thickne 0–15 $\times 10^{-5}$ cm, and refractive index 1·2·75.

535.321.5 : 535.81 90

A rapid non-destructive method of determining th refractive index of lens components, using a spectrometer JACOBSOHN, S., BELOIAN, E., AND HESS, H. *J. Opt. So Amer.*, **37**, 941–3 (*Dec.*, 1947).—The method describe uses a divided-circle spectrometer with exit slit an hollow, 60° prism, in which the lens element is immerse using a liquid of $\sim$ the same index. The refraction c light through the cylindric edge of the lens is viewe through the exit slit. Instead of adjusting the liqui exactly to the index of the lens, an approximate match i made, and the residual difference of indices is determine by measuring the deviations at the two places on the edg at which the angle of incidence is 45°; this is evidenced b the coincidence, as seen through the exit slit, of the brigh line on the edge of the lens with marks previously place there. The mean of the two measured deviations a minimum determines the refractive index of the liquid and their difference gives the correction to be applied t the latter for the index of the lens. Two instrumen set-ups are described, one using one spectrometer an low pressure Hg lamp with filters, the other using spectrometer, monochromator, and high pressure H lamp. A

535.324 : 532.122 : 539.89 91

The refractive indices of alcohol, water, and thei mixtures at high pressures. ROSEN, J. S. *J. Opt. Soc Amer.*, **37**, 932–8 (*Nov.*, 1947).—The effect of pressur up to 1 800 kg/cm² was measured for the Hg arc lines o wavelengths 579, 546, 436 and 406 mμ. There is a approximate decrease of 0·6 to 1% in the Lorentz–Loren "constant," 0·1 to 0·45% deviation in the Gladstone an Dale "constant," and 0·2 to 0·6% in the empirica Eykman formula. It is concluded that with none of thes formulae can the compressions of the solutions be com puted from the refractive-index measurements with an great accuracy. The specific refractions of Gladston and Dale are found most suitable for a mixture formul which holds as well through the pressure range o 1 500 atmos. as at atmospheric pressure. Compression calculated from refraction formulae are found to be linear function of the observed compressions of th solutions. An equation is given which reproduces wit great precision the refractive indices of alcohol, wate and their mixtures; its logarithmic term is the same a that in the Tait equation for compressibilities, and th part containing the refractive indices involves the sam function which appears in the formulae of Gladston and Dale, Lorentz–Lorenz, etc. A

535.33 911

On the spectrum of the rhenium atom, Re I. KLINKEN BERG, P. F. A. *Physica, 's Grav.*, **13**, 581–604 (*Nov.* 1947).—The analysis of the spectrum of neutral Re i revised and extended with 10 even and 55 odd energy levels. The number of newly classified lines is ~ 700 so that at present 1 171 spectral lines are accounted for as 1 183 transitions between 29 even ground levels, 12 middle odd levels and 14 high even levels. A review i

n of all previous researches. New arc-, spark- and ow cathode spectrograms have been obtained and an roved separation of Re I and II is made. Preliminary rferometric studies reveal clearly resolved hyperfine cture patterns apart from the 5 resonance lines which e been the object of several investigations by other ıors. Tables of the known energy levels and of all sified Re I lines are given. Some difficulties in rpretation of the empirical terms are discussed. A.

.33 : 539.153 *see Abstr.* 1029

.33–15 : 621.383.4 : 537.312.5 *see Abstr.* 971

33–32 912

pectra of highly ionized atoms. EDLÉN, B. *Physica, ırav.*, **13**, 545–54 (*Nov.*, 1947).—A review dealing with progress achieved in recent years in extending the ervable range of ionization stages and in extending the ssible range of optical wavelengths further down into X-ray region, with particular reference to the work ried out at Uppsala. A.

.33.072–14 913

Microwave spectrum frequency markers. CARTER, L., AND SMITH, W. V. *Phys. Rev.*, **72**, 1265–6 (*Dec.* 15, 7).—Frequency marking was achieved by introducing radiation from an auxiliary microwave oscillator into wave guide, thus producing an interference "pip" en the main oscillator sweep passes through the iliary frequency. Weak coupling of the two oscillators ures the reproduction of an identical interference tern on successive sweeps. This pattern can be stepped applying an intermediate-frequency voltage to the ector of the auxiliary oscillator. Such markers have n used with spacings varying from 0·2 to 10 Mc/s.
W. E. D.

.33.072–14 : 538.569.4 914

A double modulation detection method for microwave ctra. WATTS, R. J., AND WILLIAMS, D. *Phys. Rev.*, 1122–3 (*Dec.* 1, 1947).—A similar arrangement to that d by Gordy and Kessler [Abstr. 88 (1948)] is reported.
W. E. D.

.33.072–15 915

An infra-red spectrophotometer for industrial research. ARTIN, E. J., FISCHER, A. W., MANDEL, B., AND SBAUM, R. E. *J. Opt. Soc. Amer.*, **37**, 923–31 (*Nov.*, 47).—The source of radiation is a Nernst glower, the persing unit a 10×15 cm NaCl prism, and the tector is a compensated thermopile. The output of the rmopile is amplified with a contact modulated amplifier. e installation is comparatively insensitive to mechanical ration and fast temperature changes, and is enclosed a vacuum tank to prevent interference from absorption extraneous gases. Driving motors for prism rotation d slit adjustments are outside the vacuum and rotary tion is transmitted through the walls of the tank by ans of magnetic drives. Ink-line records of the spectral nge 3–15 μ can be made automatically in 30 min. The trument is operated semi-automatically for "spot rk" in making quantitative analyses after spectral sitions and proper calibrations have been made. A.

5.33.072–15 916

Recording and control system for infra-red spectrotometer. RASSWEILER, G. M., LISTON, M. D., LASH, F., AND FRY, D. L. *J. Opt. Soc. Amer.*, **37**, 963–74 ec., 1947).—The recording system employs a contact-odulated amplifier and self-balancing potentiometer an electrical null circuit including variable response eed and gain. The control system automatically adjusts e slits and zero at preselected prism positions. Familiar spectra illustrate the effects of variables such as slit width, recording speed, and response speed. A.

535.331 917

Erratum: The arc spectrum of silver. SHENSTONE, A. G. *Phys. Rev.*, **72**, 1273 (*Dec.* 15, 1947).—See Abstr. 2448 (1940).

535.331 : 523.87 *see Abstr.* 814

535.338.334 : 533.7 : 535.343.4–14 *see Abstr.* 923

535.341–15 : 541.57 : 539.133 918

The experimental determination of the intensities of infra-red absorption bands. III. Carbon dioxide, methane, and ethane. THORNDIKE, A. M. *J. Chem. Phys.*, **15**, 868–74 (*Dec.*, 1947).—[For II, see Abstr. 1818 (1947)]. The absolute intensities $\times 10^{-10}$ have been determined experimentally to be (in cycles/cm at N.T.P.): Carbon dioxide: 670 cm^{-1}, 560; 2 350 cm^{-1}, 8 600. Methane: 1 306 cm^{-1}, 450; 3 020 cm^{-1}, 900. Ethane: 820 cm^{-1}, 73; 1 450 cm^{-1}, 230; 2 950 cm^{-1}, 2 200. These results are in satisfactory agreement with available data on infra-red dispersion and atomic polarization. They may be interpreted in terms of dipole moments, μ', of bonds between vibrating atoms, and their rates of change with internuclear distance, $\partial\mu'/\partial r$. When this is done for the CH bond, however, unexpected variations in these quantities are found for the different vibrations and molecules studied. The average values are $\sim \mu' = 0{\cdot}4\times10^{-18}$, $\partial\mu'/\partial r = \pm 0{\cdot}6\times10^{-10}$. For the CO bond the values are considerably larger. A.

535.343–15 : 535.231.4 *see Abstr.* 904

535.343.2 : 535.544 : 526.424.1 : 548.33 *see Abstr.* 1113

535.343.2–15 919

Prism spectrometry from 24 to 37 microns. PLYLER, E. K. *J. Chem. Phys.*, **15**, 885–6 (*Dec.*, 1947).—KRS–5 (Tl bromide–iodide) has good transparency and dispersion to nearly 40 μ; the dispersion is very low between 2 and 15 μ. Graphs of transmission of AgCl, KBr, polyethylene and polystyrene, measured with a 26° prism of KRS–5, calibrated by using known absorption bands, are shown for the region 24–37 μ.

535.343.2–15 : 545.82 *see Abstr.* 1111

535.343.2–15 : 548.0 920

The infra-red spectrum. RAMAN, C. V. *Curr. Sci.*, **16**, 359–66 (*Dec.*, 1947).—The author briefly reviews the development of this subject, with special reference to his own theories on the vibration spectra of crystals.

535.343.3–15 921

Self-filling micro infra-red absorption cell. COLTHUP, N. B., AND WILLIAMS, V. Z. *Rev. Sci. Instrum.*, **18**, 927–8 (*Dec.*, 1947).

535.343.4–14 922

Saturation effect in microwave spectrum of ammonia. POND, T. A., AND CANNON, W. F. *Phys. Rev.*, **72**, 1121–2 (*Dec.* 1, 1947).—The 3,3 line has been examined at low pressures and at powers ~ 1 μW, and both an absorption saturation effect and a broadening of the line with increased power was observed. W. E. D.

535.343.4–14 : 535.338.334 : 533.7 923

Pressure broadening of the inversion spectrum of ammonia. II. Disturbance of thermal equilibrium at low pressures. BLEANEY, B., AND PENROSE, R. P. *Proc. Phys. Soc., Lond.*, **60**, 83–98 (*Jan.*, 1948).—See Abstr. 2105 (1947). The absorption at the centre of the line (3,3) of the centimetre wavelength inversion spectrum has been measured at pressures between 1·5 mm and 0·01 mm Hg. The absorption coefficient is constant at the higher pressures, as would be expected for a single line whose width is determined solely by pressure broadening. At

the lower pressures the absorption coefficient falls by an amount dependent on the energy density in the resonator; this is due to the disturbance of thermal equilibrium in the gas through the absorption of energy from the radio-frequency field. A theory of the effect is developed from which the thermal relaxation time can be calculated by comparison with the experimental values of the absorption coefficient. It is found that this time is approximately $1{\cdot}7_5\times$ the mean time between collisions which interrupt the absorption (determined from the line breadth constant). This indicates that not every such collision is effective in restoring thermal equilibrium. A.

535.343.4–14 : 537.228.5 924

Stark effect in high frequency fields. TOWNES, C. H., AND MERRITT, F. R. *Phys. Rev.*, **72**, 1266–7 (*Dec.* 15, 1947).—Experimental curves are given showing how the a.c. Stark effect follows the d.c. pattern for low frequency, splits into a more complicated pattern at intermediate frequencies which have a value of the same order as the $\frac{1}{2}$-width of the absorption line, then becomes similar again to the d.c. pattern at high frequencies. [The diagrams in Figs. 1 and 2 are interchanged in error.] W. E. D.

535.343.4–14 : 539.133 925

Microwave spectra: methyl cyanide and methyl isocyanide. RING, H., EDWARDS, H., KESSLER, M., AND GORDY, W. *Phys. Rev.*, **72**, 1262–3 (*Dec.* 15, 1947).—The $J = 0 \rightarrow 1$ transition in CH_3CN yields a quadrupole coupling coefficient for N of $4{\cdot}67 \pm 0{\cdot}10$ Mc/s differing from the value obtained by Townes *et al.* [Abstr. 2612 (1947)] from ClCN. Results for CH_3NC indicated a coupling coefficient < 1 Mc/s. Observations on the $J = 1 \rightarrow 2$ transition in CH_3CN are consistent with a symmetrical configuration, but no certain explanation can be given for the structure of the corresponding transition in CH_3NC. W. E. D.

535.343.4–14 : 539.133 926

The microwave spectrum of iodine monochloride at 4½ centimeters wave-length. WEIDNER, R. T. *Phys. Rev.*, **72**, 1268–9 (*Dec.* 15, 1947).—Values for the rotational constant, moment of inertia and interatomic distance are deduced for ICl^{35} and ICl^{37} from the absorption spectra. The absorption in the wings of the lines differs by $\sim$ a factor of 5 from that given by the Van Vleck–Weisskopf theory [Abstr. 748 (1946)]. W. E. D.

535.343.4–14 : 539.152.1 : 539.132 *see Abstr.* 1017

535.345.6 : 771.534.581 927

Red and infra-red filters for the study of the Herschel effect. BÄCKSTRÖM, H., AND BASBERG, J. *J. Opt. Soc. Amer.*, **37**, 891–8 (*Nov.*, 1947).—The contradictory literature about the Herschel effect can largely be explained by the fact that sufficiently safe filters are not used for the red exposure. The part of the actinic light that may pass the red filter without complications is extremely small. A few red filters and tests made with them are described, and further conditions for good results with Herschel filters are mentioned. A.

535.345.6–31 928

Christiansen filters for the ultra-violet. SINSHEIMER, R. L., AND LOOFBOUROW, J. R. *Nature, Lond.*, **160**, 674–5 (*Nov.* 15, 1947).—See Abstr. 598 (1947). Benzene–alcohol mixtures can be used with fused quartz chips for the region 3 000–4 000 Å. Information is given of the use of decahydronaphthalene/cyclohexane mixtures with quartz chips for 2 350–3 000 Å.

535.35 : 539.15 : 535.2 929

Imprisonment of resonance radiation in gases. HOLSTEIN, T. *Phys. Rev.*, **72**, 1212–33 (*Dec.* 15, 1947).—It is known that resonance quanta are highly absorbable by normal atoms of the emitting gas; hence, unde suitable conditions of gas density the eventual escape o these quanta from a gas-filled enclosure may require large number of repeated absorptions and emissions This "radiative" transport of excitation is determine essentially by the probability, $T(\rho)$, that a quantu traverses a layer of gas of thickness, ρ, without bein absorbed; the dependence of $T(\rho)$ on the frequenc distribution of the resonance line is investigated, an explicit expressions are derived for the cases of Döppler and dispersion broadening. The general transpor problem is formulated in terms of a Boltzmann-typ integro-differential equation involving $T(\rho)$; the varia tional method of obtaining steady-state solutions of thi equation is discussed. The theory is then applied to the evaluation of the rate of decay of excitation in an ∞ slab the results are compared with Zemansky's measurement of the decay of radiation from an enclosure of Hg vapour Finally, the application of the theory to a number o problems concerning excited atoms is discussed briefly. A

535.371 93

Spectroscopic evidence for activation of fluorescenc by high valency manganese ions. SZIGETI, G., NAGY, E. AND MAKAI, E. *J. Chem. Phys.*, **15**, 881–2 (*Dec.*, 1947).—The emission spectra of Mn-activated ZnBe silicate o Zn silicate phosphors were each found to be made up o four Gaussian curves, with maxima at $h\nu = 2{\cdot}35$, $2{\cdot}27$ $2{\cdot}17$ and $2{\cdot}05$ eV, though the intensity relations were different. The absorption spectrum of K_2MnO_4 i strong alkaline solution was identical with the emissio spectrum of the ZnBe silicate, and those of $KMnO_4$ an $Zn(MnO_4)_2$ showed the same bands as Zn silicate though in different proportion. It is inferred that the emission centres are supplied by $(MnO_4)^-$ and $(MnO_4)^{=}$ ions embedded in the silicate lattice, 10^{14}–10^{17} centres/g being required; i.e. $0{\cdot}1\%$ of the Mn only needs to be present in 6- or 7-valent state to account for the fluorescence.

535.371.07 : 535.242 *see Abstr.* 905

535.371.07 : 621.397.6 : 535.642.2 *see Abstr.* 943

535.372 93

Emission spectra of some zinc sulfide and zinc–cadmium sulfide phosphors. BYLER, W. H. *J. Opt. Soc. Amer.*, **37**, 920–2 (*Nov.*, 1947).—Emission spectra of 30 phosphors with varied Cd content and different activators are shown. The spectra were obtained with a grating spectrograph using photographic recording, and the curves are plotted in terms of relative energy. Peaks and plateaus appear repeatedly at certain positions. Analysis indicates that the broad emission bands are actually summations of contributions from a number of individual bands whose peak positions are invariant. Since these bands are found in the samples containing no added activator and since all of the activated samples show them in certain wavelength ranges, it is concluded that they are characteristic of the base material rather than the activator. Bands peaked at the following approximate positions were found: 430, 475, 520, 555, 575, 600 and 625 mμ. It is suggested that these different bands are related to differences in types of atomic groupings in the base material. The activator serves to influence the relative heights of the bands and may accomplish this through a differential influence on the ratio of radiative to non-radiative transitions in the different centres. A.

535.375.5 : 548.7 932

Vibration spectra of the alkali halides. KRISHNAN, R. S. *Nature, Lond.*, **160**, 711–12 (*Nov.* 22, 1947).—Raman spectra of an NH_4Cl crystal recorded at progressively lower temperatures showed the appearance of

eral lines even above the so-called λ-point transition, l, at liquid air temperature, sharp lines at 183 and cm^{-1} frequency shift [see Abstr. 1169 (1935)]. The mer corresponds to the "Restrahlen" of the crystal, l is evidence for the oscillation of the NH_4 groups as vhole against the Cl ions being Raman-active in the t order, instead of being inactive as in the metallic ides, where the ion has octahedral symmetry.

5.376 933

Cathodoluminescence emission spectra of zinc-oxide osphors. SHRADER, R. E., AND LEVERENZ, H. W. *Opt. Soc. Amer.*, **37**, 939–40 (*Nov.*, 1947).—An ultra-let emission band has been reported, which appears ly when cathode-ray current density is high, and has a ch shorter decay time than the visible luminescence. internal u.v. absorption process, saturable at an upper it of radiation density, is suggested in explanation, d such an absorption has been detected by observations diffuse reflectivity of the phosphors.

5.39 934

Optical impedance and surface coating. KRONIG, R., AISSE, B. S., AND V. D. SANDE, J. J. *Appl. Sci. Res.*, I (*No.* 1) 63–76 (1947).—The advantages of introducing e concept of optical impedance or admittance when aling with the reflection of plane light waves at the ane surface of a system of parallel layers of different edia, as used for instance in surface coating, is pointed it. In analogy with the theory of electric circuits this ncept is employed to express the reflection factor of ch systems. The new language is illustrated for some pical examples with the aid of impedance or admittance agrams in the complex plane. In a brief historical ference attention is called to the relation of the present oblem to similar problems in other branches of hysics. A.

35.39 : 535.514.2 : 535.321 *see Abstr.* 908

35.39.096 935

The variation with temperature of metallic reflectivity. VEIL, R. *Proc. Phys. Soc., Lond.*, **60**, 8–13 (*Jan.*, 1948).—is shown that, assuming free electrons alone to be sponsible for the mechanism of metallic reflection, ere is a wavelength at which the temp.-variation of eflectivity is zero. Since this wavelength $\propto$ the time of laxation of the electrons it is to be concluded that it aries with the temperature. The effect of the bound ectrons is also considered. A.

35.41 : 535.43 936

Interference fringes produced by scattering and reflection. HOPPER, V. D. *Proc. Roy. Soc. Vict.*, **58** (*Pts I–II*) 9–80 (1947).—When a partly polished optical flat was laced face downwards on a standard flat, and illuminated y a small bright white-light source, the pattern orresponding to the colours of thick plates was observed ncompassing the image of the source. When the top urface of the standard flat was aluminized, the pattern as much more intense. A new phenomenon occurred hen the pair of plates was illuminated by light from a g lamp which passed through a narrow slit, the single attern giving place to two separate patterns, whose ntersections gave the locus of the pattern observed with hite light. When the scattering surface was made semi-eflecting, the double set of patterns became sharper, ne set being localized in the plane of the scattering surface, the other in planes corresponding to the position of the Newton ring pattern formed by multiple reflections. Various experiments are described for studying these patterns. It is concluded that all three systems of fringes are produced by multiple reflections between the two reflecting surfaces, the assumption of Stokes that the colours of thick plates could only be produced by light passing and repassing the same particle being unnecessary. It is considered that the pattern corresponding to the colours of thick plates is produced by the summation of the intensities of the light from a pair of separate patterns of the simpler Newton ring type, one set being produced by light scattered by the top surface and then suffering multiple reflections between the surfaces before reaching the observer, the other set being produced by light from the source suffering multiple reflections between the plates, and finally being scattered by the scattering centres. A.

535.417 : 532.72 *see Abstr.* 850

535.421 937

Concave metallic replica gratings. ŠIMON, I. *Rev. Sci. Instrum.*, **18**, 894–6 (*Dec.*, 1947).—A method is described of producing metallic replicas from gratings by electro-deposition of Cu. It is possible to obtain concave replicas from a convex original grating—either metallic or glass. The optical figure and the grating qualities of the replicas are tested and shown in figures. A.

535.43 : 534.213 938

Light-scattering in homogeneous media regarded as reflexion from appropriate thermal elastic waves. BHATIA, A. B., AND KRISHNAN, K. S. *Proc. Roy. Soc. A*, **192**, 181–95 (*Feb.* 4, 1948).—Attributing the scattering of light in a homogeneous transparent liquid to the local fluctuations in density, and the latter to the superposition of the thermal elastic waves of different wavelengths maintained in the enclosure, one may, following Einstein, evaluate the scattering coefficient of the liquid along any given direction. The expression for the scattering coefficient involves a triple ∞ series, which Einstein evaluated by replacing it by a triple integral. The series, however, can be summed directly, and the contributions from different progressive waves to scattering studied in detail. This method brings out prominently the appropriateness of regarding scattering as regular Bragg reflections from suitable elastic waves, and also reveals interesting features. The intensities of the Brillouin components are calculated on this basis, both in a fluid medium and in a crystal; and in the latter case the expression for the overall intensity of the Brillouin components is shown to be identical with the well-known expression of Waller in X-ray scattering. A.

535.43 : 535.41 *see Abstr.* 936

535.43 : 536.48 : 530.162 939

Entropy fluctuations in liquid helium II and the Rayleigh line. AGARWALA, B. K., AND CHOWDRI, A. G. *Nature, Lond.*, **160**, 750 (*Nov.* 29, 1947).—The undisplaced component of the Rayleigh line in the scattered light spectra of liquids is attributed to entropy fluctuations, which can be regarded as stationary, in contrast to the density fluctuations, moving with the velocity of Debye waves, responsible for the two displaced components. In liquid He II, the entropy fluctuations are also moving (second sound) so that there should be 4 displaced and no undisplaced components.

535.43.07 : 576.8.093.6 940

A photoelectric nephelometer. UNDERWOOD, N., AND DOERMANN, A. H. *Rev. Sci. Instrum.*, **18**, 665–9 (*Sept.*, 1947).—The instrument described does not require a precision optical system or an electronic amplifier. It measures the growth of *E. coli* from a starting conc. of $\sim 2\times10^6$ bacteria per ml. A horizontal beam of light passes through the vertical test tube containing the specimen. The light scattered downward is measured with a barrier-layer photo-cell. A.

535.514.2 : 535.39 : 535.321 *see Abstr.* 908

535.544 : 535.343.2 : 536.424.1 : 548.33 *see Abstr.* 1113

535.55 = 6 941

Measurement of elastic stresses. III. Photoelasticity. RICALDONI, J. *Publ. Inst. Estática, Fac. Ing. Montevideo* (*No.* 5) 85 *pp.* (*Oct.*, 1947) *In Spanish.*—The theoretical parts of elasticity and optics necessary for an understanding of photoelasticity are abstracted from more detailed works on the subject. H. G. J.

535.551 ; 678 : 539.31 *see Abstr.* 1087

535.642 942

The most probable colorimetric tensor derived from "*n*" colour matchings. SILBERSTEIN, L. *Phil. Mag.*, **39**, 82–3 (*Jan.*, 1948).—Correction to an earlier paper [Abstr. 314 (1947)]. L. S. G.

535.642.2 : 535.371.07 : 621.397.6 943

Application of I.C.I. color system to development of all-sulfide white television screen. HARDY, A. E. *RCA Rev.*, **8**, 554–63 (*Sept.*, 1947).—Increased emphasis on the whiteness of the television tube screen has demanded the use of an objective colour-specification system in the development of new phosphors and in the control of the finished tube. The I.C.I. colour system provides accurate colour control and permits the determination of desirable and undesirable colour areas and facilitates the obtaining of the greatest luminosity for any desired white. Measurements of the relative efficiencies and spectral energy distribution of individual phosphors and phosphor mixtures have been made in a demountable c.r.t. with an automatic recording spectroradiometer. Particular emphasis has been placed on the factors that are peculiar to ZnS and (Zn,Cd)S phosphors. A.

535.767 944

A certain class of binocularly equivalent configurations. STEIN, A. *J. Opt. Soc. Amer.*, **37**, 944–62 (*Dec.*, 1947).—Two experiments are described, which show that binocular vision does not always provide absolute localization of objects, and that two different targets may be located in the same place, if inclination and shape are suitably chosen. The problem is analysed geometrically, and two theorems of projective properties of conic sections are found to have application. A.

535.8 945

Stray light caused by the presence of a luminous body within the field of an optical system. COLEMAN, H. S. *J. Opt. Soc. Amer.*, **37**, 899–906 (*Nov.*, 1947).—Various optical systems, with coated and non-coated lenses, were tested. The luminous body was 10–10 000 × the brightness of the target. Contrast-rendition values ranged from 90 to 1%, with coated lenses showing somewhat better values, though all systems showed a rapid deterioration of contrast rendition when angles between target and light source become < a few degrees. A.

535.8 946

A new type of reflecting sight. VOGL, J., AND TÄCKLIND, S. *J. Opt. Soc. Amer.*, **37**, 975–8 (*Dec.*, 1947).—This paper describes a reflecting sight in which a mirror objective is used instead of a usual lens. The instrument becomes very small and the optical element is simple even for a large field of view. The astigmatism produced by the oblique reflecting plate is compensated by an off-centre cylindrical lens. The problem is mathematically solved. A.

535.8 : 535.245 947

Illumination in the focal plane of a camera lens. CLANCY, E. P. *J. Opt. Soc. Amer.*, **37**, 906–8 (*Nov.*, 1947).—Direct photoelectric measurement has been made of illumination in the focal planes of typical photographic objectives. The results in many cases differ seriously from what might be expected simply on the basis of th cos⁴ law plus vignetting. The deviation takes the for of an unexpectedly large rate of decrease of illuminatic with respect to distance from the axis, and may be s great as to have important consequences on work i colour photography and photographic photometry. Th effect is apparently inherent in the design of almost an photographic objective.

535.81 : 535.321.5 *see Abstr.* 909

HEAT 536

536.2.081.7 : 621.315.615.2.017.7 = 3 94

The thermal transfer coefficient of transformer oi GOTTER, G. *Elektrotechnik, Berlin*, **1**, 169–76 (*Dec* 1947) *In German.*—[Abstr. 878 B (1948)].

536.212 94

Thermal conductivity of metals at high temperature: I. Description of the apparatus and measurements on iro ARMSTRONG, L. D., AND DAUPHINEE, T. M. *Canad. Res. A*, **25**, 357–74 (*Nov.*, 1947).—An apparatus utilizin unidirectional heat flow in a cylindrical sample in vacuum is described. The advantages of the metho are outlined and a comprehensive analysis of possibl errors in the measurements is included. Measurement on Armco iron indicate that results with an absolut error of < 2% may be obtained. The results of measure ments on a sample of Armco Fe gave thermal conduc tivities of $0{\cdot}181_9$ c.g.s. units at 0°C and $0{\cdot}069_8$ c.g.s units at 800°C. A change in slope of the thermal cor ductivity — temperature curve was found at a tempera ture of ~ 375°C, and is tentatively attributed to th presence of 0·03% Ni impurity.

536.222 : 532.74 95

Heat conductivity and molecular complexity of wate MOHANTY, S. R. *Curr. Sci.*, **16**, 339 (*Nov.*, 1947).—It shown from published data that there is a linear relatio between the heat conductivity and the association factc at various temperatures between 10 and 70°C. [Se Abstr. 2131 (1947)].

536.24 : [621.313.045.017.7 + 621.315.34.017.7] = 3 95

Treatment of stationary heat flows by electrica analogues. MOELLER, F. *Elektrotech. u. Maschinenb* [*EuM*] **61**, 4–8 (*Jan.* 8, 1943) *In German.*—By comparin the formulae for stationary heat flow to those o electrical flow it is shown that Ohm's and Kirchhoff' laws apply to both, and therefore also the laws of serie and parallel connection. Some difficulty is encountere by the fact that heat resistances are frequently mor temp.-dependent than electrical resistances. The appli cation of the electrical potential analyser for solvin thermal problems is described and the heating of a co and of bundles of conductors within a trough are give as examples. Also the treatment of surface and spatia heat flows are briefly dealt with. Bibliography. R. N

536.242 95

On the theory of heat transfer from a wire in a electric field. KRONIG, R., AND SCHWARZ, N. *Appl Sci. Res.*, **A1** (*No.* 1) 35–46 (1947).—If an electric field i applied between a horizontal heated wire and a con centric cylinder filled with gas, the heat transfer from th wire is increased due to the electrostrictive forces whic modify the circulation current of free convection [Abstr 5190 (1936)]. A new electrical characteristic number i introduced which makes it possible to represent th phenomena in a single graph. From this graph th extra heat loss caused by an electric field of cylindrica symmetry around any horizontal wire in an arbitrar gas can be read off directly. A

.242 : 533.275 : 545.7 *see Abstr.* 1109

.423 : 536.632/.633 *see Abstr.* 955

.423.4 : 533.52 : 545.7 *see Abstr.* 1110

.424.1 : 535.544 : 535.343.2 : 548.33 *see Abstr.* 1113

.468 : 537.521.7 : 621.366 : 621.3.064.2 = 397 953

gnition of explosive gas mixtures with l.v. sparks. LLER-HILDEBRAND, D. *Tekn. Tidskr.*, **77**, 761–8 t. 11, 1947) *In Swedish.*—Chemical processes at ition, activation energy and effect of heated surfaces briefly discussed, and spark and arc formation at the ening of a switch is dealt with. A series of experiments the ignition of a 22% H_2-air mixture was carried using repeated openings (4 per sec) of a switch with m silver-wire contacts, and a 6 V accumulator as rce. Diagrams show ignition probability as a function the current, with a 10 mH inductance in the circuit, ignition current as function of inductance with ying ignition probabilities. The procedure is described d the results are discussed. Some indications on rent intensities that may safely be interrupted in drocarbon–air mixtures are given. J. A. W.

6.48 954

A new technique for studying the helium film. BROWN, B., AND MENDELSSOHN, K. *Nature, Lond.*, **160**, 670 *Nov.* 15, 1947).—If a capillary leak connecting two ssels, one containing liquid He below the λ point, is de small enough, the passage of He gas can be made gligibly small, but liquid He II will travel through the k by film transfer into the second chamber. The phase system, film/gas, can thus be studied in the sence of the bulk liquid. It was found that by warming e second chamber slightly, the pressure in it (vapour essure of the film) could be raised to 2 × that above e bulk liquid He.

6.48 : 530.162 : 535.43 *see Abstr.* 939

6.48 : 534.22 *see Abstr.* 862

6.48 : 534.321.9 : 534.614 *see Abstr.* 885

6.48 : 539.4 : 539.374 *see Abstr.* 1097

6.48 : 539.89 : 541.123 *see Abstr.* 1102

6.632/.633 : 536.423 955

Heat capacities of liquids and vapors. BENSON, S. W. *Chem. Phys.*, **15**, 866–7 (*Dec.*, 1947).—By the use of equation previously derived [Abstr. 2427 (1947)] the energy of vaporization of a liquid: $\Delta E = (D_l^n - D_g^n)$ (in which k is a constant; $n = 5/3$; and D_l and D_g are the molar densities of liquid and vapour, respectively), an expression is derived relating $(\partial\Delta E/\partial T)_{sat}$ to the difference in molar heat capacities at constant pressure of the liquid and vapour (ΔC_p). At low pressures this relation can be approximated by the equation $\Delta C_p = (\partial\Delta E/\partial T)_s + R$. ($R$ is the gas constant, 1·986 cal/mole-Å.) Under these conditions $(\partial\Delta E/\partial T)_s = (5/3)\Delta E(\partial \ln D_l/\partial T)_{sat}$, and the resulting equation for ΔC_p is $\Delta C_p = (5/3)\Delta E(\partial \ln D_l/\partial T)_{sat} + 1{\cdot}99$. From known properties of liquids ΔC_p can be calculated using this last equation. These calculated values are found to be in good agreement with observed experimental values. A.

536.653 : 537.311.3 : 539.11 *see Abstr.* 1015

THERMODYNAMICS 536.7

536.7 956

Thermodynamical properties of ethylene as function of pressure and temperature between 0 and 2 500 atmospheres and 25° and 150°C. MICHELS, A., DE GROOT, S. R., AND GELDERMANS, M. *Appl. Sci. Res*, **A1** (*No.* 1) 55–65 (1947).—See Abstr. 2588 (1946). Values of pressure × volume, energy, kinetic energy, entropy, free energy, enthalpy, thermodynamic potential and specific heats have been calculated for round values of temperature and pressure between 25° and 150°C up to 2 500 atmos. A.

536.7 : 530.145 957

The kinetic basis of thermodynamics. BORN, M., AND GREEN, H. S. *Proc. Roy. Soc. A*, **192**, 166–80 (*Feb.* 4, 1948).—In this paper the thermodynamical properties of any system whatsoever are deduced from quantum mechanics. Two fundamental irreversible processes are considered: the conversion of other forms of energy into heat, and the flow of heat from one temperature to another. By the proof of a generalized H-theorem, it is shown that in each case the entropy, correctly defined, must increase, and the system tend towards a state of equilibrium. A simple but rigorous proof of Boltzmann's law is given from which the thermodynamics of reversible processes may be inferred. An appendix includes the exact solution of the most general time-dependent perturbation problem of quantum mechanics. A.

536.7 : 532.74 *see Abstr.* 851

536.75 : 532.77 958

A note on the relation between entropy and enthalpy of solution. RICE, O. K. *J. Chem. Phys.*, **15**, 875–9 (*Dec.*, 1947).—The relation between entropy and enthalpy of solution for a series of non-polar solutes in a given non-polar solvent is discussed. It is considered that solution of a gaseous solute, without changing its concentration on going from gas phase to liquid solution phase, does not change its own entropy, all change of entropy being referred to the solvent. The entropy of the solvent changes because of surface effects around the solute molecules and a kind of long-range order introduced by the solute molecules. Two extreme cases are considered, (1) the case of an ideal solution, and (2) the case of a solute of hard attractionless spheres. The difference in entropy of solution between these extreme cases can be estimated. It can also be estimated by extrapolation from the experimental data on the entropy and enthalpy of solution, and these two estimates agree in order of magnitude. The fact that the relation between entropy and enthalpy of solution is linear is also shown to be a reasonable expectation, and effect of changing solvent as well as solute is considered. The groundwork is thus laid for a qualitative understanding of this relation between entropy and enthalpy of solution. A.

536.782 959

The Joule–Thomson effect in ethylene. DE GROOT, S. R., AND GELDERMANS, M. *Physica, 's Grav.*, **13**, 538–42 (*Nov.*, 1947).—Calculations have been made on the basis of experimental data on compressibility and specific heat at zero pressure. The coefficient is given in tables and graphs as a function of the temperature between 25 and 150°C, and of the pressure up to 2 500 atmos. A.

536.782 : 533.7 *see Abstr.* 855

ELECTRICITY 537

537.12 : 539.166.835 = 5 *see Abstr.* 1057

537.122 : 530.145 960

On the theory of point electrons. DIRAC, P. A. M. *Phil. Mag.*, **39**, 31–4 (*Jan.*, 1948).—An answer to criticism by Lewis [Abstr. 1623 (1946)] of the author's work on the classical equations of motion for point electrons. This work is explained more clearly and it is shown that certain equations may be obtained without meeting the difficulties mentioned by Lewis. L. S. G.

537.122 : 539.185 *see Abstr.* 1075–6

537.122 : 551.594.9 : 523.53 *see Abstr.* 811

537.133 : 539.152.1 : 537.534.74 *see Abstr.* 981

537.2 : 538.3 961

The experimental basis of electromagnetism. II. Electrostatics. CAMPBELL, N. R., AND HARTSHORN, L. *Proc. Phys. Soc., Lond.*, **60**, 27–51 (*Jan.*, 1948).—See Abstr. 108 (1947). This paper explores the foundations of the science of electrostatics as practised in the modern laboratory, admitting as evidence only those experiments that experience has proved to be practicable. The basis of the subject is found in alternating currents and the laws of capacitance, which lead to the conception of electric potential energy. The various experiments on the mechanical forces between electrified bodies fit in well with this conception, and lead to the conclusion that the soundest procedure in the investigation of any system of conductors and dielectrics is to represent it by its equivalent capacitance network. Coulomb's Law and point charges play no part in the scheme, but they are discussed because of the prominent part that they play in classical theory. The familiar equations for point charges, which are the premises from which that theory starts, can be regarded as definitions of what is meant by "point charge," or as approximations to the laws governing the forces on small charged bodies, which become true in a limiting case. One incidental advantage of the treatment is that the somewhat elusive notion of "earth" in the usual expositions is replaced by more definite conceptions. A.

537.226 : 621.315.61 962

Work function and energy levels in insulators. WRIGHT, D. A. *Proc. Phys. Soc., Lond.*, **60**, 13–22 (*Jan.*, 1948).—An estimate is made for several insulators of the energies of the highest filled energy band and of the empty conduction band. For BaO, SrO, CaO, MgO and BeO, the bottom of the conduction band is near the zero level. It is considerably lower in AgBr, ZnO and ZnS. The bearing of the results on thermionic emission, secondary emission and photoconductivity is briefly discussed, with special reference to BaO and SrO. A.

537.226.1 : 539.13 963

The dielectric properties of water and heavy water. COLLIE, C. H., HASTED, J. B., AND RITSON, D. M. *Proc. Phys. Soc., Lond.*, **60**, 145–60 (*Feb.*, 1948).—Measurements by a number of different methods of the permittivity and loss angle of H_2O and D_2O at 3 widely separated wavelengths in the region of anomalous dispersion, $\lambda = 10$ cm, 3 cm, 1·25 cm, are described. Results show that the Debye equations are exactly obeyed, there being a single time of relaxation varying with the temperature; the ratios of the relaxation times of H_2O and D_2O are found to be in quantitative agreement with the ratios of the viscosity over a temperature range, suggesting that the re-orientation mechanism in these liquids is the same as that of viscosity. The value of the activation energy of the re-orientation process is discussed. The value of 5·5 found for the optical permittivity gives a reasonable result for the permittivity of water on the Onsager theory. This theory is discussed and shown to give a relaxation equation of the Debye type for alternating fields. A.

537.226.1 : 539.501 : 541.182.6.025 *see Abstr.* 1103

537.226.1.08 964

The cavity resonator method of measuring the dielectric constants of polar liquids in the centimetre band. COLLIE, C. H., HASTED, J. B., AND RITSON, D. M. *Proc. Phys. Soc., Lond.*, **60**, 71–82 (*Jan.*, 1948).—A method described of determining the refractive index n of a pola liquid in the centimetre band by measuring the resonanc curve of an H_{01} resonator with an axial capillary c liquid. The theory is worked out, and tables provide for quantitative calculations. An independent value c κ is required. The method has been tried out on wate at 21°C, and is capable of $\pm$ 1% accuracy.

537.226.33 96

Dielectric residual effects in titanates. PARTINGTON J. R., PLANER, G. V., AND BOSWELL, I. I. *Nature Lond.*, **160**, 877–8 (*Dec.* 20, 1947).—The permittivity an loss of samples were observed at 1 kc/s over a period c time following the application and removal of a stron d.c. electric field. At temps. < that corresponding t permittivity maximum, a temporary increase (3–6%) c both was observed, falling to the initial values in 10 50 min, and being more pronounced the higher the temp At temps. > the permittivity maximum the opposit effect occurred, being greater for high fields and lon applications.

537.226.8 : 541.57 : 539.132 *see Abstr.* 1019

537.228.1 : 666 = 5 96

Piezo dielectric effect and its measurement in glass RICAMO, R. *Nuovo Cim.*, **4**, 233–50 (*Oct.*, 1947) *I Italian.*—After a general survey of the previous experi mental work on the electrostrictive and piezodielectri effect, a theoretical discussion of the effects is given especially on the reciprocity relation between them Measurements are reported on the piezodielectric effec in glass. A cylindrical glass tube capacitor with silvere inner and outer surface electrodes, was stressed normall to the lines of electric forces under various loads, an the variation of its capacity was measured. For th glass sample examined, the piezodielectric coefficien $(1/\varepsilon)d\varepsilon/dp$ was found to be $-2{\cdot}3 \times 10^{-12}$ m²/newton i accordance with previous results of Wüllner and Wie [Abstr. 922 (1903); 1502 (1904)]. The result afford definite evidence that the effect consists certainly in diminution of the permittivity, when glass is stressed i a direction perpendicular to the lines of the electri force. A

537.228.4 : 666 96

Time factor in electric birefringence of glass. MITRA P. *Curr. Sci.*, **16**, 310 (*Oct.*, 1947).—Varieties of glas other than dense flint glass have been found to exhibit decreasing birefringence under steady fields for som minutes after the maximum has been reached (whic may itself take up to 1 min). In the case of glasses fre from lead, it even decreases through zero to a negativ value. On removal of field, the reverse cycle is followed It appears that two effects are superimposed, but electro striction is too small to account for the negative effect.

537.228.5 : 535.343.4–14 *see Abstr.* 924

ELECTRIC CURRENTS 537.3

537.311.1.029.5 96

The conductivity of metals at microwave frequencies SERIN, B. *Phys. Rev.*, **72**, 1261–2 (*Dec.* 15, 1947).—Using Boltzmann's equation, an expression for the r.f conductivity, σ_{rf}, is derived in terms of σ_{dc}. The ratio σ_{rf}/σ_{dc} is found to decrease with the ratio of the electron mean free path to skin depth. The direct relation between σ_{rf} and σ_{dc} is determined by a self-consistent calculation By relating σ_{dc} to temp., it is seen that σ_{rf}/σ_{dc} decreases rapidly with decrease of temp. W. E. D.

537.311.3 : 536.653 : 539.11 *see Abstr.* 1015

311.33 : 537.312.5 : 621.314.632 :
537.311.4 *see Abstr.* 970

.311.33.096 : 539.234 969

onductivity of evaporated films of lead selenide. PSON, O. *Nature, Lond.*, **160,** 791–2 (*Dec.* 6, 1947).— electrical conductivity of 0·5 μ films on Pyrex roximately followed the law $\sigma(T) = a\,\epsilon^{bT}$, which ifferent from bulk PbSe. This can be accounted for assuming that the resistance lies mainly in the gap ween individual microcrystals, and quantitative eement between theory and experiment is plausible. ther confirmation is given by the increase of resistance he film by 5% when the Pyrex base was mechanically tched by 0·01%, thus widening the gap between the rocrystals. At − 100°C, the films exhibit photo-nductivity to infra-red radiation as far as 5 μ [Abstr. (1948)].

.311.4 : 537.311.33 : 537.312.5 : 621.314.632 970

Excess-defect germanium contacts. BENZER, S. *Phys. v.*, **72,** 1267–8 (*Dec.* 15, 1947).—A cell consisting of a tallic point making contact with a thin layer of type Ge on a *P*-type crystal of Ge acts as a photo-diode, d the characteristics are given for various intensities of umination. The "dark" current varies with the abs. mp., T, as $\exp(-e\phi/kT)$; ϕ has a value $\sim 0{\cdot}7$ eV, ich $\simeq$ the width of the forbidden band in Ge as duced from resistivity/temp. measurements. [See str. 2151 (1947), 123 (1948)]. W. E. D.

7.312.5 : 535.33–15 : 621.383.4 971

Lead selenide cells for infra-red spectroscopy. BLACK-LL, D. E., SIMPSON, O., AND SUTHERLAND, G. B. B. M. *ture, Lond.*, **160,** 793 (*Dec.* 6, 1947).—Photo-nductive PbSe films evaporated in vacuo on to Pyrex ates [Abstr. 969 (1948)] are superior in sensitivity to good vacuum thermocouple as far as 4 μ, and have o peaks, at 1·6 and 3·3 μ. Sensitivity below 3 μ is t as high as a PbS cell. Response time < 50 μsec.

7.312.5 : 537.311.33 : 621.314.632 :
537.311.4 *see Abstr.* 970

7.312.5 : 548.74 *see Abstr.* 1121

37.312.62 972

The effect of annealing and gas content on the super-nducting properties of tantalum. WEBBER, R. T. *ys. Rev.*, **72,** 1241–5 (*Dec.* 15, 1947).—The super-nducting transition temperatures and critical fields of ree wires of 99·9+% pure Ta, taken from the same ool, have been investigated to find the effect of anneal-g and gas content. Annealing the metal at very high mperatures raised the transition temperature from 156 to 4·32°K and lowered the initial slope of the itical magnetic field from 1 360 to 600 gausses/deg. uch sharper transitions were observed for the annealed ecimens. The effect of absorbed gas was slight. pontaneous fluctuations of resistance on the transition to superconductivity were observed. The effect of the ecimen current on the critical field was studied in one f the annealed specimens. A.

37.312.62 : 538.12 973

Penetration of magnetic field into superconductors. AURMANN, E., AND SHOENBERG, D. S. *Nature, Lond.*, 60, 747–8 (*Nov.* 29, 1947).—The variation with tem-erature was measured by observing the mutual in-uctance of two coils wound on a massive super-nducting core as temperature was lowered [Abstr. 3155 1946)]. The expected variation was found for both Hg nd Sn, agreeing with other measurements [Abstr. 526 (1947)] in the case of Sn. For Hg, some variation as found, which was attributed to a dependence of penetration depth on direction of current flow relative to the crystal axes.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.521.7 : 621.366 : 621.3.064.2 :
536.468 = 397 *see Abstr.* 953

537.525 : 551.594.221 974

Ionization processes in a long discharge tube with application to lightning mechanism. MITCHELL, F. H., AND SNODDY, L. B. *Phys. Rev.*, **72,** 1202–8 (*Dec.* 15, 1947).—Properties of the progressive breakdown, occurring when an impulsive potential is applied to an electrode in one end of a 14-cm dia., 12-m long, discharge tube have been investigated, principally by means of a high speed c.r.o. Potentials from 25 kV to 115 kV and pressures from 0·006 to 8·0 mm Hg were used, with dry air and H_2 in the tube. Conditions in the discharge, when comparatively large over-voltages are impressed, have been discussed by several investigators, particularly with respect to impulses of positive polarity and in tubes of smaller diameter. These observations have now been extended to include the negative polarity. In addition, a low-speed, low-potential process has been obtained and its properties analysed. A possible application of the lightning theory to such discharges is given. The low-speed impulse resembles the hypothetical lightning pilot streamer as to speed and current, and the speed $\simeq$ the drift speed of electrons in the tip field, as assumed for the pilot streamer. The high speed processes are more similar to the lightning dart leaders. It is pointed out that conditions in the tube are such that propagation in this case may be controlled more by the presence of photo-electrons ahead of the tip than by a preliminary ionizing leader. A.

537.525.6 : 621.385 975

Plasma-electron oscillations. ARMSTRONG, E. B. *Nature, Lond.*, **160,** 713 (*Nov.* 22, 1947).—A brief report is given of observations made on the h.f. oscillations generated in thermionic tubes containing gas at low pressures. Wavelengths as low as 5 cm have been detected. The amplitude and frequency of the oscillations depend markedly on the position on the voltage-current characteristic of the valve, and there are sometimes more than one region in which oscillations may occur. Different frequencies may sometimes be picked up by a probe in different regions of the discharge. Effects of magnetic fields on the oscillation intensity are reported, and possible mechanisms for the maintenance of the oscillations discussed (e.g. "Barkhausen–Kurz," with a potential maximum in the plasma as "positive grid"; coupling of plasma to discontinuous disappearance and formation of the potential minimum within the space-charge sheath.)

537.525.72 : 537.533.8 976

Starting potentials of high-frequency gas discharges at low pressure. GILL, E. W. B., AND VON ENGEL, A. *Proc. Roy. Soc. A*, **192,** 446–63 (*Feb.* 18, 1948).—The starting field strength of an electrodeless discharge at pressures of $\sim 10^{-3}$ mm Hg in He, Hg, H_2 and air, is found to be independent of the gas and only slightly dependent on its pressure. By increasing the wavelength (> 4 m) the starting field varies first inversely with the wavelength, then becomes constant, and at a critical value rises discontinuously probably to ∞. This cut-off wavelength is proportional to the diameter of spherical and the length of cylindrical vessels respectively, the axis of the cylinder being parallel to the field. The facts indicate that direct ionization by collision with the gas

cannot account for the multiplication of the few electrons originally present. A theory is worked out on the basis that secondary emission from the walls is the operative factor. The initial electrons assumed to move singly in vacuum come to life at various phase angles of the alternating field. However, only those contribute effectively to the multiplication process whose transit time between the walls corresponds to one or an odd number of half-cycles, and whose velocity is large enough to liberate from the wall more than one secondary electron. For each phase angle an appropriate transit time, that is, an appropriate wavelength, can be found to give this requisite final velocity so that discharges are possible over a limited range of wavelengths corresponding to the allowable phase angles. From similarity follows the proportionality between cut-off wavelength and the size of the vessel. This theory agrees well with the experimental results. The dependence on secondary emission was confirmed by coating the inner glass wall with a poor secondary emitter; the starting field is increased, while the cut-off wavelength decreases; the reverse is observed when clear Pyrex glass with a larger secondary emission is exchanged for soda glass. A.

537.525.8 : 537.533 = 5 977

On the various phases of a type of glow discharge with electronic field emission, and its dynamic characteristics. DASCOLA, G. *Nuovo Cim.*, **4**, 63–73 (*Feb.*, 1947) *In Italian.*—Researches on the discharge of Güntherschulze and Fricke [Abstr. 4641 (1937)] have been extended to low currents, using different cathodes. The analogies with ordinary discharges are shown, and the existence of subnormal, normal and abnormal phases demonstrated. In the abnormal phase the discharge voltage is practically independent of pressure, which supports the hypothesis of electron production by field emission from the cathode. A.

537.525.8 : 537.534 *see Abstr.* 980

537.527.5 978

Theory of high pressure mercury vapour discharge. BURGESS, R. E. *Phil. Mag.*, **39**, 83 (*Jan.*, 1948).—An integral appearing in an earlier paper [Abstr. 1536 (1947)] is expressed in terms of tabulated functions, and some numerical errors are corrected. L. S. G.

537.529 : 548.0 : 539.166.08 *see Abstr.* 1055

537.531 : 537.533.75 *see Abstr.* 979

537.531 : 621.386.1 : 615.849 *see Abstr.* 1136

537.533 : 537.525.8 = 5 *see Abstr.* 977

537.533.75 : 537.531 979

Some experiments with fast electrons and positrons produced by a 20-MeV betatron. BOSLEY, W., CRAGGS, J. D., AND NASH, W. F. *Nature, Lond.*, **160**, 790–1 (*Dec.* 6, 1947).—A brief report of work in progress on (*a*) spectrum of X-rays and γ-rays by cloud-chamber measurement of energy distribution of electron/positron pairs; (*b*) energy losses suffered by fast electrons and positrons in passing through Pb and other metals.

537.533.8 : 537.525.72 *see Abstr.* 976

537.533.9 : 537.591 *see Abstr.* 990

537.533.92 : 539.165 *see Abstr.* 1051

537.534 : 537.525.8 980

A low-pressure glow-discharge proton source. LORRAIN, P. *Canad. J. Res. A.*, **25**, 338–56 (*Nov.*, 1947).—A cold-cathode proton source operating at about 200 V at a pressure of a few microns is described. The discharge is essentially similar to that of a Philips vacuum gauge. The characteristics of the discharge, the ion extraction, and the proton production have been investigated. The addition of 10% of O_2 to the H_2 increased the prot content of the ion beam from 10 to 50% while intr ducing only about 1% of O and other foreign ions. T ionization processes are discussed.

537.534.74 : 537.133 : 539.152.1 9

Proton-proton scattering at 14·5 Mev. WILSON, R. F LOFGREN, E. J., RICHARDSON, J. R., WRIGHT, B. T., A SHANKLAND, R. S. *Phys. Rev.*, **72**, 1131–8 (*Dec.* 1947).—The scattering of 14·5 MeV protons (obtain from a 37-in synchrocyclotron) by protons has be studied by using a coincidence counting method. T measurements of the differential scattering cross-sectic are absolute and extend from 10° to 45°. The accura was not high, ~ 10%, because the pulsed nature of t synchrocyclotron beam introduced a large background accidental counts. At small angles the scattering significantly > that predicted by *S*-wave scattering onl This indicates the effect of *P*-wave scattering such as th due to a repulsive potential well. The results are n inconsistent with those found at 8 and 10 MeV.

537.534.75 : 539.185.08 : 539.164.75 *see Abstr.* 1050

537.534.75 : 778.3 9

A calibration for Eastman proton plates. PEC R. A., JR. *Phys. Rev.*, **72**, 1121 (*Dec.* 1, 1947).—T stopping power of these plates was found to vary rapid for proton energies up to about 5 MeV, above which remained constant. W. E. I

537.542 9

Some experiments with adjustable Geiger-Müll counters. CHAUDHRI, M., AND FENTON, A. G. *Pro Phys. Soc., Lond.*, **60**, 183–93 (*Feb.*, 1948).—Speci counters are described in which it is possible to alter t effective length as well as the material and diameter the anode without opening them. It was observed tha while in a given counter the anode material and t nature of its surface have little or nothing to do with t characteristics, there is an optimum anode diameter f which the best plateaux are obtained. The phot sensitivity to visible light and longer wavelengths caus by high counting rates or by "continuous" discharg was shown to be due to some surface phenomenon o the cathode. It has been shown in a simple manner tha the discharge is not localized, but spreads along the lengt of the counter. It was observed that the plateau lengt and slope improve at first, but then deteriorate when th effective length of the counter is reduced by shielding th anode wire at both ends with glass capillary tubes. Wit metal capillaries, however, the plateau characteristics ar best when the full length of the cathode is used.

537.542 : 535.14.08 = 4 98

An equation for the curve $I = f(N)$ connecting th luminous flux received by a photon counter with the numbe of discharges counted. LORMEAU, S. *C.R. Acad. Sci Paris*, **225**, 865–7 (*Nov.* 10, 1947) *In French.*—Continue previous work [Abstr. 138 (1948)]. A good approxima tion to the experimental curves is given by the equatio $I = C(a^N - 1)$, or with reasonable accuracy $I = aN - bN^2$ where b/a varies little from one curve, or one counte to another. L. E. M

537.542 : 539.164.08 98

A precision alpha-proportional counter. SIMPSON, J. A *Rev. Sci. Instrum.*, **18**, 884–93 (*Dec.*, 1947).—An instru ment is described which will detect and record th α-disintegration rate of prepared radioactive sample even though soft β-radiation up to 5×10^9 disintegra tions/min may also be present. The counting losse arising from the detector, electronic amplifier, scaler an recorder total 0·8% with an α-counting rate of 10^5/mi

instrument employs a proportional counter through ch 99% CH_4 at 1 atmos. slowly flows. The pro- ional counting region is ~300 V in length, with % change in counting rate in an interval of 200 V. a radioactive samples deposited on metal discs up to cm dia. are easily inserted into the counter volume by ns of a special gas lock. The counter detects 0·50 he disintegrations from a thin radioactive sample. background can be maintained at about 14 counts/hr. igh-vacuum, low-geometry attachment provides re- tions in geometry down to at least 10^{-5} of the ple counting rate. Some theory of gas-flow pro- tional counters is presented along with details of the rument construction. A.

.542 : 621.318.572 986

nalysis of the impulses from Geiger–Mueller tubes. RRAN, S. C., AND RAE, E. R. *Rev. Sci. Instrum.*, **18**, -6 (*Dec.*, 1947).—The series of pulses from a G–M is used to form a second series of pulses, each nber of which is delayed by a variable time interval tive to the corresponding member of the first. The series are mixed electrically and the coincidences nted. This method is suitable for finding the effective d-time of counters of high resolving power. The lysis readily reveals the presence of spurious pulses duced, for example, by the incidence of positive ions the cathode, and the drift time of the ions can be asured. Results for O_2, N_2, H_2 and CH_4 in con- ction with alcohol are given. Correction for the rious part of the counting rate establishes the fact that re is an appreciable inefficiency of tubes containing h mixtures when detecting β-rays. A.

.542 : 621.318.572 987

Reduction of "insensitive time" in Geiger–Müller nters. HODSON, A. L. *J. Sci. Instrum.*, **25**, 11–13 *n.*, 1948).—[Abstr. 937 B (1948)].

.562 : 539.153 988

The study of negative ions by extrapolation through electronic series. BATES, D. R. *Proc. R. Irish Acad.*, **A**, 151–61 (*Aug.*, 1947).—Glocker's computations on ctron affinities are repeated, using modern data on ization potentials. The lack of stability of N^- (as mpared with C^- and O^-, the two neighbouring gative ions) is discussed and explained. From the eral trend through the Periodic Table evidence is ovided that the electron affinity of O is $2{\cdot}2 \pm 0{\cdot}2$ eV, found by Lozier, and not $3{\cdot}07 \pm 0{\cdot}08$, as found by er and Mayer. The indications are that the extra- lation method used provides a lower estimate of the ctron affinity. It is pointed out that the order of the rious orbitals in negative ions is not necessarily the me as in neutral atoms—in particular, that there is the ssibility of the 3*s* orbital being below the 2*p* and of the orbital being below the 3*p*. Detailed examination, wever, shows that it is only for Be^- and Mg^- that this fect is likely to occur. Excited states (resulting from or 4*s* orbitals) of the other negative ions in the groups ginning with Be^- and Mg^- are considered; they must located close to the spectral head, and it is suggested at their predicted excitation energies (which are latively accurate) provide better approximations to the tachment energies from the ground state than those tained directly from ionization potentials. The state ^{2}, 2*s*, $2p^6$, ^2S of O^- is found to lie too high to provide means for appreciable dielectronic attachment to O. A.

37.583 : 621.38.032.216 989

Energy levels in oxide cathode coatings. WRIGHT, D. A. *roc. Phys. Soc., Lond.*, **60**, 22–7 (*Jan.*, 1948).—The nergy level diagram is considered in the case of a Ba/SrO emissive cathode coating, and it is concluded from the results of an earlier paper [Abstr. 962 (1948)] that the process of activation consists in building up a concentration of free Ba in the coating, and in providing Ba at the interface between core and coating. The work function of the activated coating without adsorbed Ba on its outer surface cannot be much greater than the observed value of 1 eV, and may be no greater, so that such an adsorbed layer, if present, has only a small effect on the work function. The possibility of increase in emission under the influence of ultra-violet light or electron bombardment is briefly discussed. A.

COSMIC RAYS 537.591

537.591 : 523.161 *see Abstr.* 808

537.591 : 537.533.9 990

On the radiation emitted by a fast charged particle in the magnetic field. TZU, H. Y. *Proc. Roy. Soc. A*, **192**, 231–46 (*Feb.* 4, 1948).—Pomeranchuk has shown that electrons with energies $> 10^{17}$ eV passing through the earth's magnetic field lose most of their energies. It is shown in this paper that the energy lost is transformed into some 600 photons of very high energy. These photons are distributed along a very narrow band of several decimetres or even only several centimetres length. The magnetic field of the earth can influence appreciably neither the energy spectrum nor the spread of extensive showers. Its main effect consists in shifting the shower maximum to a higher altitude. Something like the cascade process might be developed by a very fast electron before it reaches the top of the atmosphere. A.

537.591 : 539.18 *see Abstr.* 1071

537.591 : 539.18 = 5 *see Abstr.* 1072

537.591.08 991

On the application of captive balloons to carry photographic emulsions. ARLEY, N. *Phys. Rev.*, **72**, 1253 (*Dec.* 15, 1947).

537.591.1 : 539.17 992

Origin of cosmic ray stars at sea-level. PERKINS, D. H. *Nature, Lond.*, **160**, 707–8 (*Nov.* 22, 1947).—Evidence is presented for assuming that the number of nuclear disintegration stars produced in photographic emulsions ∝ the (much larger) number of single tracks. The effect of absorbers on the latter is then taken to show the absorption of the star-producing radiation; it is much greater per m water-equivalent for air than for Pb. The high absolute intensity of stars, the low absorption in Pb, and the absence of correlation of stars with showers, seem to rule out photons as the shower-producing agency, and neutrons would need a cross-section too high for the observed Pb absorption. It is concluded that the radiation is largely made up of unstable particles, which, since their density increases rapidly with altitude, are probably uncharged.

537.591.15 993

Production of penetrating particles in extensive air showers. BROADBENT, D., AND JÁNOSSY, L. *Proc. Roy. Soc. A*, **192**, 364–80 (*Feb.* 18, 1948).—The paper analyses experimental material reported earlier [Abstr. 909–10, 2929 (1947), 364 (1948)]. The production of penetrating particles in the air above the apparatus is ruled out, also their production by secondary nucleons arising in local absorbers, in view of the absence of a transition effect in paraffin, and the arrival of the penetrating particles in groups. The production of mesons in local absorbers by electrons or photons would seem to neces-

sitate a much stronger interaction than is likely, and a corresponding reverse process for mesons, which has not been observed. It therefore appears unlikely that the particles produced in the shower are mesons.

537.591.15 = 5 994

On an extension of the theory of low-energy showers. II. DALLAPORTA, N., AND POIANI, G. *Nuovo Cim.*, **4**, 1–9 (*Feb.*, 1947) *In Italian.*—The results of a former paper [Abstr. 1898 (1947)] on the distribution function for low energies in showers in Pb are now extended to take full account of the Compton effect for the photon component and of energy loss by ionization for the electron component. The results so obtained are compared with the former ones. A.

537.591.15 = 5 995

On the presence of a penetrating component in extensive air showers. MURA, A., SALVINI, G., AND TAGLIAFERRI, G. *Nuovo Cim.*, **4**, 10–23 (*Feb.*, 1947) *In Italian.*—An investigation was made at 2 100 m above sea level, using a single arrangement of G–M counters. The components were separated according to their different penetrating power, their different multiplication probability while crossing thick Fe or Pb layers, and their different absorption by elements of different atomic number (Fe and Pb). Measurements show the presence in extensive showers of a non-multiplying component which is more penetrating than electrons. Were this component due to mesons, these would have a spectrum of lower energies than the mesons present in the total radiation. It is discussed whether the penetrating component may be generated, at least partially, within the Pb- or Fe-absorbers. An account is given of cloud-chamber photographs taken in coincidence with the extensive showers detected by the counter arrangement. A.

537.591.15 = 5 996

Observation in the Wilson chamber of lateral spread of extensive shower particles. MURA, A., SALVINI, G., AND TAGLIAFERRI, G. *Nuovo Cim.*, **4**, 102–11 (*June*, 1947) *In Italian.*—Cloud-chamber photographs of extensive cosmic ray showers are examined with reference to the question of lateral spread of shower particles. It is observed that investigations on average density and lateral distribution of shower particles are not actually independent, and the distribution of the numbers of the incoming tracks on the individual photographs is thereby calculated. By comparison of the calculated distribution with the experimental one, it is concluded that the experimental results may be accounted for by assuming that the dependence of the number of showers on the density Δ is expressed over a wide range by the law $f(\Delta)d\Delta = k\Delta^{-\gamma}d\Delta$, proposed by Cocconi, Loverdo and Tongiorgi [Abstr. 909 (1947)]. The value $\gamma = 2{\cdot}6$ is deduced, in satisfactory agreement with the earlier determination of the above-mentioned authors. There is no evidence to show that condensations of particles may occur in extensive showers. A.

537.591.15 = 5 997

Interpretation of extensive air showers on the cascade theory. COCCONI, G. *Nuovo Cim.*, **4**, 227–32 (*Oct.*, 1947) *In Italian.*—Calculations on the effect of atmospheric pressure variations on the frequency and density spectrum of showers are given, and the results compared with previous experimental results. The cascade theory is shown to account for a considerable number of phenomena. Experimental results on the barometric effect and the variation with height of penetrating showers are scarce, but seem to point to a connection with extensive air showers. A.

537.591.15 : 523.746 99

Relation of frequency of occurrence of small cosmic-ra bursts to areas of sunspots and other variables. BROXO J. W. *Phys. Rev.*, **72**, 1187–96 (*Dec.* 15, 1947).—Th analysis of frequency of small bursts [Abstr. 375 (1947 is continued. A weak correlation with the daily averag ionization current in the chamber was observed. Puls in the burst frequency curve of >7% from the mean a found associated with primary pulses in sunspot are roughly opposite in phase. No clear-cut relation to th magnetic character is indicated. A large negative bar metric coefficient was found for the burst frequen amounting to ~ −3 to −4% per mm Hg. An explan tion is offered.

537.591.3 99

Abnormality in cosmic-ray absorption in lead in lo latitudes. SWANN, W. F. G., AND MORRIS, P. A. *Phy Rev.*, **72**, 1262 (*Dec.* 15, 1947).—Absorption curves take at high and low latitudes reveal at low latitudes a fairl sudden increase in absorption at 22 cm of Pb which i not apparent at magnetic latitude 51·5°N. Such a increase has already been observed at Bangalore at abou the same thickness of Pb (21 cm), which leads to th suggestion that the effect is intimately associated wit Pb, as the Bangalore results were obtained at a heigh equivalent to 7 cm of Pb above the present low latitud work. W. E. D

537.591.5 100

Sea level latitude effect of cosmic radiation. MORRI P. A., SWANN, W. F. G., AND TAYLOR, H. C. *Phys. Re* **72**, 1263–4 (*Dec.* 15, 1947).—The latitude effect for th hard and soft components of the vertical radiation i found to be ~ 5% for both (measured on sea voyag between Rio de Janeiro and Boston). W. E. D

537.591.8 = 5 100

On the electronic component in the low atmosphere BERNARDINI, G., CACCIAPUOTI, B. N., AND QUERZOLI, E *Nuovo Cim.*, **3**, 349–71 (*Dec.*, 1946) *In Italian.*—Exper ments on the meson/electron equilibrium are discusse Formulae are deduced by means of which are calculated (*a*) Number of secondary electrons generated in Pb i equilibrium with the meson component; (*b*) number c knock-on secondaries generated in the atmosphere (*c*) number of disintegration secondaries. The calculate results are then compared with the experimental data.

537.591.8 = 5 100

On the generation in paraffin of ionizing penetratin particles by non-ionizing cosmic radiation. MILONE, C AND TONGIORGI, V. *Nuovo Cim.*, **4**, 146–52 (*June*, 194 *In Italian.*—The conclusion is reached in disagreemen with other authors that the process at sea level is no detectable. The process of generation of knock-o secondary particles by penetrating radiation has bee studied. The behaviour of paraffin does not differ fro that of high atomic number materials.

MAGNETISM 538

538 : 530.1 *see Abstr.* 817

538.12 : 537.312.62 *see Abstr.* 973

538.12 : 621.318.3.013.2 100

Magnetic field configurations due to air core coil BLEWETT, J. P. *J. Appl. Phys.*, **18**, 968–76 (*Nov.*, 1947).— [Abstr. 932 B (1948)].

538.213.096 = 5 100

On an anomalous variation of permeability as a functio of temperature. MONTALENTI, G. *Nuovo Cim.*, **4**, 161– (*June*, 1947) *In Italian.*—The anomalous behaviour wa

d in Fe containing 4% Si, in a certain field range in
:h conspicuous temporary variation of permeability
s at low field values as a result of demagnetization. A.

221 : 621.396.11 : 538.56 *see Abstr.* 1011

222 1005

he role of exchange interaction in paramagnetic
rption. GORTER, C. J., AND VAN VLECK, J. H.
s. Rev., **72**, 1128–9 (*Dec.* 1, 1947).—The fact that the
magnetic absorption of anhydrous chromic, man-
ous, ferric and gadolinium salts and of hydrated
ic salts disappears for values of the perpendicular
$\ll$ the internal field is shown mathematically to be
to exchange interaction between the ions. W. E. D.

222 1006

aramagnetic resonance absorption in salts of the iron
up. CUMMEROW, R. L., HALLIDAY, D., AND MOORE,
Phys. Rev., **72**, 1233–40 (*Dec.* 15, 1947).—When a
magnetic salt is placed in a h.f. alternating magnetic
which is perpendicular to a static magnetic field,
gy may be absorbed by the salt in a resonant fashion
a range of values of the steady field. These para-
gnetic losses have been investigated for three man-
ous, two cupric, and one chromic salt at a frequency
9 375 Mc/s. Well-defined absorption maxima were
ained in all cases, and absolute values of χ'', the
ginary part of the h.f. magnetic susceptibility, are
sented. A.

.222 : 539.15 : 551.594.6 1007

he paramagnetic susceptibility of atomic oxygen.
HLFARTH, E. P. *Proc. Leeds Phil. Lit. Soc.*, **4**, 315–22
c., 1946).—Calculations are carried out using the
plete quantum mechanical expression for atoms for
ch the energy separations of the lowest states are
mparable with kT. Direct experimental verification of
results would be extremely difficult, but precise
ctroscopic information is available for atomic oxygen,
there are no complicating effects as in solids, so the
culated results may be accepted as reliable. The results
ow that the temperature-variation of the susceptibility
iates considerably from that given by a Curie law,
over the whole range the gram-atomic susceptibility
of O $>$ that of O_2; e.g. at 300°K the values are
88×10^{-3} and $3{\cdot}31\times10^{-3}$, respectively. A series of
ues is given in a table and the temperature-variation
er the range 0–400°K of $1/\chi_M$, p_B (the effective Bohr
gneton number) and the volume susceptibility are
own in figures. As there are relatively large amounts
atomic oxygen in the upper atmosphere, the results
ve a bearing on the propagation of wireless waves in
s region. A.

8.222 : 539.152.2 *see Abstr.* 1027

8.24 : 621.318.24 : 621.3.018.44 = 82 1008

kin-effect in a ferromagnetic cylinder for sub-low
quencies. LAVRENTJEV, S. S. *J. Tech. Phys., USSR*,
(*No.* 7) 817–24 (1946) *In Russian.*—[Abstr. 819 B
48)].

ECTROMAGNETISM . ELECTRODYNAMICS
538.3/.5

8.3 : 537.2 *see Abstr.* 961

8.31 : 539.32.08 *see Abstr.* 1093

8.521 : 621.396.611.1 = 4 1009

On a new phenomenon of electromagnetic induction due
negative ions. IONESCU, T. V., AND MIHU, V. P.
R. Acad. Sci., Paris, **224**, 1349–51 (*May* 12, 1947) *In*
ench.—A Geissler tube is placed in the interior of a
il which is the resonator of an oscillating circuit. The intensity of the current in the circuit depends upon the intensity of the current in the tube. The results are presented of some experiments on the variation of the energy of the resonator with the frequency, when the gas in the tube is H_2 at various pressures, and for constant discharge currents. It is shown that negative ions are always produced if the electric field of the ionized gas is weak. L. S. G.

538.521 : 621.396.611.1 = 4 1010

On an explanation of a phenomenon of electromagnetic induction due to negative ions. IONESCU, T. V. *C.R. Acad. Sci., Paris*, **225**, 232–4 (*July* 28, 1947) *In French.*—A theory of previous experimental results is produced [see Abstr. 1009 (1948)]. An expression for the current in the resonator is derived and a study of this shows the existence of resonance effects encountered in the experiments. L. S. G.

538.56 : 530.12 *see Abstr.* 819

538.56 : 538.221 : 621.396.11 1011

Reflection of microwaves by ferromagnetic materials. EICHHOLZ, G., AND HODSMAN, G. F. *Proc. Leeds Phil. Lit. Soc.*, **4**, 303–13 (*Dec.*, 1946).—Starting from the general solution of Maxwell's field equations, formulae have been obtained giving the reflectivities of metals for plane and guided waves, over the frequency range 10^9–10^{13} c/s. In both cases, the reflection coefficient differs only slightly from unity. In the case of plane linearly polarized waves with direction of polarization in the plane of incidence, it is found that only near to glancing incidence is the value of the reflection coefficient markedly different from unity and it is then independent of the properties of the conductor. The critical angle of incidence does depend, however, on the nature of the metallic reflector but is always very nearly 90°. For waveguides, the reflection coefficients are again practically equal to unity even for films whose thickness $\simeq$ the skin-depth of penetration. The theory seems to indicate that the permeability of ferromagnetic materials cannot readily be obtained from waveguide measurements. Some qualitative experimental evidence is quoted in support of the general conclusions. A.

538.561 : 621.392.2 = 4 1012

Electromagnetic theory of Lecher wires and some associated problems. OSWALD, J. *Onde Élect.*, **27**, 330–40 (*Aug.-Sept.*, 1947) *In French.*—[Abstr. 982 B (1948)].

538.566.3 : 550.38 : 621.396.11 1013

Experimental determination of the gyrofrequency. SEATON, S. L. *Science*, **106**, 496–7 (*Nov.* 21, 1947).—Some 800 selected ionospheric records taken in Alaska were examined, and the penetration frequency of the (*a*) longitudinal ordinary ray, (*b*) transverse ordinary ray, (*c*) extraordinary rays for both modes determined. Graphs are given of the variation with height of the precession frequency and gyrofrequency of electrons in the earth's magnetic field obtained from these values. The latter, obtained from longitudinal propagation modes, agrees with the theoretical curve; the curve obtained from the transverse modes, however, lies $\sim 0{\cdot}08$ Mc/s on the high frequency side of it, and there is also a distinct discrepancy between the slopes over the range of height of the sporadic E-layer. It is suggested that the inverse-cube variation of the earth's magnetic field, on which the theoretical curve is based, may be disturbed by atmospheric current flow at heights < 100 km.

538.566.3 : 550.38 : 621.396.82 1014

Gyro-interaction of radio-waves obtained by the pulse method. CUTOLO, M. *Nature, Lond.*, **160**, 834 (*Dec.* 13,

1947).—By using pulsed transmissions from the disturbing station, reliable observations could be made with lower power, in spite of frequent bad atmospheric disturbance. The gyro-frequency, and thus the total terrestrial magnetic field in the ionosphere, was measured throughout the night on several occasions between January and July, 1947, in Italy, by varying the frequency of the disturbing station until maximum interaction was noted. The gyro-frequency usually rose steadily during the night; the interaction was strongest between 2 and 3 a.m. local time.

538.569.4 : 535.33.072–14 *see Abstr.* 913

MAGNETIC EFFECTS 538.6

538.615 : 539.181 : 539.153 *see Abstr.* 1030

ATOMIC AND MOLECULAR STRUCTURE 539

539.11 : 536.653 : 537.311.3 1015

Quantum mechanical calculation of the heat of solution and residual resistance of gold in silver. KUN HUANG. *Proc. Phys. Soc., Lond.*, **60**, 161–75 (*Feb.*, 1948).—An attempt is made to calculate the heat of solution of Au in Ag on the basis of the quantum theory of metals. Replacement of a Ag atom by a Au in the lattice can be represented by a potential hole which alters the energy of the conduction electrons. Calculations using the Thomas–Fermi method give a result of 0·15 eV per atom for the heat of solution (observed value, 0·13 eV). The residual resistance of Au in Ag is calculated to be 0·16 $\mu\Omega$ cm for 1% solution (observed value 0·38). The discrepancy seems closely connected with similar ones found in work on temp./resistance of noble metals.

A.

539.11 : 539.31 1016

On the pressure-volume and pressure-compressibility relation of metals. GOMBÁS, P. *Phys. Rev.*, **72**, 1123–4 (*Dec.* 1, 1947).—The author has extended his theory [Abstr. 1918 (1946)] to enable comparison to be made with Bridgman's work [Abstr. 2225 (1941)] and theory is found to be in reasonable agreement with experiment.

W. E. D.

539.13 : 533.7 = 5 *see Abstr.* 856

539.13 : 537.226.1 *see Abstr.* 963

539.13 : 541.64 : 532.7 *see Abstr.* 846

539.132 : 539.152.1 : 535.343.4–14 1017

On the nuclear electric quadrupole interaction in molecular spectra. FELD, B. T. *Phys. Rev.*, **72**, 1116–17 (*Dec.* 1, 1947).—An attempt is made to correlate the results of experimenters, as the symbols involved in the quadrupole coupling term are defined differently by the various workers.

W. E. D.

539.132 : 541.57 1018

Interaction terms in molecular vibrations. COULSON, C. A., DUCHESNE, J., AND MANNEBACK, C. *Nature, Lond.*, **160**, 793–4 (*Dec.* 6, 1947).—The magnitudes and signs of the terms for triatomic molecules *XYZ* have been investigated, arising from (*a*) resonance effects; (*b*) interaction between non-bonded atoms (*X* and *Z*); (*c*) changes of hybridization at the central atom (*Y*). An example of each of these three effects is given, and the calculated sign shown to agree with experiment.

539.132 : 541.57 = 3 1019

Resonance and hydrogen bonding of the carboxyl- and amide-groups. WIRTZ, K. *Z. Naturforsch.*, **2a**, 264–71 (*May*, 1947) *In German.*—Molecules with carboxyl- and amide-groups exhibit exceptionally strong H bonding, e.g. the double molecules of carboxylic acids. The ma part of the bonding energy arises from the electrosta attraction of the opposite dipoles, but in addition hitherto unknown non-electrostatic contribution mu be postulated to account for the observed bond energi which depends on special binding relations within t carboxyl and amide groups concerned with a tr resonance of the α-electrons of the C-, O- and N-aton This resonance has been investigated by the method Hund, Mulliken and Hückel, which has been extend to the case of the relationship of the π-eigenfunctions different atoms. Theory and experiment are in sat factory agreement. The resonance is most incomplete the undissociated monomeric groups, on account of t dissimilarity of the two canonical valency structure It is better when the molecule can form a hydrogen bon since the structure then becomes symmetrical. The mo complete case is that of the COOH ion, whereby th cause of the acidic character is explained. The streng of the H bond of such groups depends in part on the fa that its inner resonance is improved by the formation the H bond. A calculation is given for the acetic ac double molecule which affords a value of ~ 2 kca per H bond.

H. H. H

539.132 : 541.57 : 537.226.8 10

Nature of the hydrogen bond in potassium hydrog fluoride. POLDER, D. *Nature, Lond.*, **160**, 870–1 (*Dec.* 2 1947).—The temp. coefficient of dielectric permittivity KHF$_2$ has been determined to be $\sim +2\times10^{-4}$ betwe 80° and 300°K, which confirms Pitzer and Westrum conclusions [*J. Chem. Phys.*, **15**, 526 (1947)].

539.133 : 535.343.4–14 *see Abstr.* 925–6

539.133 : 541.57 : 535.341–15 *see Abstr.* 918

539.15 : 535.2 : 535.35 *see Abstr.* 929

539.15 : 539.18 = 5 *see Abstr.* 1073

539.15 : 551.594.6 : 538.222 *see Abstr.* 1007

539.152.1 10

Nuclear forces and the magnetic moment of the deutero MASSEY, H. S. W., AND HU, T.-M. *Nature, Lond.*, **16** 794–5 (*Dec.* 6, 1947).—Values have been calculated of th range a of four different nucleon interaction functions r/a (r = nucleon separation), using as experimental da for the evaluation of the constants the collision cros section of thermal neutrons with protons, the bindin energy and quadrupole moment of the deuteron, an one of the following: magnetic moments of proto neutron and deuteron; cross-section for elastic collisio of 1–6 MeV protons with neutrons; anomalous scatterin of protons by protons; binding energy of triton. Th values of a so obtained are mutually consistent for eac of 3 of the forms of $f(r/a)$ [spherical well, $\exp(-r^2/a^2$ $-\exp(-2r/a)$]; the Yukawa potential, $(a/r)\exp(-r/a$ gives inconsistent results.

539.152.1 : 530.14 *see Abstr.* 822

539.152.1 : 535.343.4–14 : 539.132 *see Abstr.* 1017

539.152.1 : 537.133 : 537.534.74 *see Abstr.* 981

539.152.1 : 539.185 10

On the determination of phase shifts. RAMSEY, W. I *Proc. Camb. Phil. Soc.*, **44** (*Pt I*) 87–95 (1948).—A approx. formula for the phase shifts which arise in th calculation of the scattering of particles is develope and applied to the neutron-proton interaction in nuclear field described by a Yukawa potential. Th approximations are more accurate than those obtaine from Born's formula or Pais's formula [Abstr. 840 (1946) The method is applicable to the computation of ar quantity which is sensitive to the form of the wav function near the centre of force.

L. S.

152.1 : 539.185 *see Abstr.* 1077

152.2 1023

ie magnetic exchange moments for H_3 and He_3. ARS, F. *Helv. Phys. Acta*, **20** (*No.* 6) 476–90 (1947).—ge exchange is shown to give a contribution to the netic moment of the 3-body system in its ground . A calculation, carried through for the case of the metrical pseudoscalar meson theory, gives a value of of a nuclear magneton for this exchange moment. sign is + for H_3, − for He_3. This result furnishes an pretation of the value of μ_{H3} measured by Bloch Anderson [Abstr. 1592–3, 1926–7 (1947)]. A.

152.2 1024

measurement of the deuteron proton magnetic-moment . BITTER, F., ALPERT, N. L., NAGLE, D. E., AND , H. L. *Phys. Rev.*, **72**, 1271 (*Dec.* 15, 1947).—gnetic resonance nuclear absorption measurements quid H and D gave $\mu_D/\mu_H = 0{\cdot}307021 \pm 0{\cdot}000005$. W. E. D.

.152.2 1025

elative nuclear moments of H^1 and H^2. BLOCH, F., INTHAL, E. C., AND PACKARD, M. E. *Phys. Rev.*, **72**, 5–6 (*Dec.* 1, 1947).—Nuclear induction experiments a value of $3{\cdot}257195 \pm 0{\cdot}00002$ for the ratio of the gnetic moment of H^1 to D^2. W. E. D.

.152.2 = 5 1026

elativistic corrections in the calculation of the magnetic ment of the deuton. CALDIROLA, P. *Nuovo Cim.*, **4**, 101 (*June*, 1947) *In Italian*.—See Abstr. 2648 (1946). s is a more detailed treatment and some errors have n corrected.

.152.2 : 538.222 1027

he nuclear magnetic moments of bromine. POUND, V. *Phys. Rev.*, **72**, 1273 (*Dec.* 15, 1947).—The para-gnetic absorption of Br compounds was investigated h a r.f. spectrometer; lines were found near 3 Mc/s y with aqueous solutions, and were ~ 10 kc/s wide. suming a value for the magnetic moment of Na^{23}, se for Br^{79} and Br^{81} are found to be $\mu_{79} = 2{\cdot}1066 \pm$ ·03 and $\mu_{81} = 2{\cdot}2706 \pm 0{\cdot}003$. W. E. D.

.153 1028

Electron momenta in atoms. DUNCANSON, W. E., AND ULSON, C. A. *Proc. Phys. Soc., Lond.*, **60**, 175–83 ., 1948).—Theoretical expressions are obtained for momentum distribution of the electrons in atoms of ferent atomic number. This enables density curves to drawn for the momentum p. The mean momentum, ich is also calculated, shows a steady increase with mic number. Finally, the new calculations of mo-ntum distribution enable earlier work on the shape of Compton profile to be extended from Na to K, in natomic form. A.

.153 : 535.33 1029

nterval formula for multiplets of atomic energy levels. AKI, G. *Phys. Rev.*, **72**, 1255–6 (*Dec.* 15, 1947).—is verified that some of the irregular multiplets of mplex atoms deviate from the Landé rule because of n-spin interaction. W. E. D.

.153 : 537.562 *see Abstr.* 988

.153 : 538.615 : 539.181 1030

Precision measurement of the ratio of the atomic "*g* ues" in the $^2P_{3/2}$ and $^2P_{1/2}$ states of gallium. KUSCH, AND FOLEY, H. M. *Phys. Rev.*, **72**, 1256–7 (*Dec.* 15, 47).—Using the atomic beam resonance method, the io of the g_J values for Ga for the $^2P_{1/2}$ and $^2P_{3/2}$ states found to be $2{\cdot}00344 \pm 0{\cdot}00012$, and not exactly 2 as uld be obtained if $g_{1/2} = 4/3$ and $g_{3/2} = 2/3$. W. E. D.

539.155 1031

Least square fit of the fundamental mass doublets. COHEN, E. R., AND HORNYAK, W. F. *Phys. Rev.*, **72**, 1127 (*Dec.* 1, 1947).—The method of least squares is used to calculate the masses of H^1, D^2, C^{12} and N^{14} by using weighted means of the best determinations available for the six mass spectra doublets: H_2^1–D^2; D_3^2–C^{12}++; $C^{12}H_4^1$–O^{16}; $C^{12}H_{2+n}^1$–$N^{14}H_n^1$; $N^{14}H_{2+m}^1$–$O^{16}H_m^1$; N^{14}–$C^{12}O^{16}$. The final values are (relative to O = 16): $H^1 = 1{\cdot}0081284 \pm 0{\cdot}0000027$; $D^2 = 2{\cdot}014718 \pm 0{\cdot}000005$; $C^{12} = 12{\cdot}003847 \pm 0{\cdot}000016$; $N^{14} = 14{\cdot}007539 \pm 0{\cdot}000015$. W. E. D.

539.155.2 : 521.042 1032

An isotopic abundance rule and its bearing on the origin of the nuclei. FRANK, F. C. *Proc. Phys. Soc., Lond.*, **60**, 211–12 (*Feb.*, 1948).—It is pointed out that the following rule is followed with few exceptions: the total cosmic abundance at each mass number (above 60) is of the same order of magnitude; where there is more than one stable nucleus of a given mass, the predominantly abundant nucleus at this mass is that of lowest charge, and the others may be much rarer. The only grave exception is the relative rarity of Re^{185}. The significance of this rule for the theory that heavier nuclei have been built up by a sequence of neutron capture processes, is pointed out.

539.155.2 : 539.163.2 *see Abstr.* 1048

539.155.2 : 539.172.4 1033

Mass spectrometric study of fission element 43. INGHRAM, M. G., HESS, D. C., JR., AND HAYDEN, R. J. *Phys. Rev.*, **72**, 1269–70 (*Dec.* 15, 1947).—The long-life isotope was found to have a mass number of 99. [See Abstr. 1045 (1948)]. W. E. D.

539.155.2 : 550.93 = 3 *see Abstr.* 1124

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16 1034

Summarized proceedings of conference on "Applications of radioactive tracer elements in physics, research and industry"—Manchester, 1947. *J. Sci. Instrum. Phys. Ind.*, **25**, 49–56 (*Feb.*, 1948).—The following papers were read: Cockcroft, J. D., "Production of radioactive isotopes by the pile and cyclotron"; Marley, W. G., "Handling of radioactive elements"; Dunworth, J. V., "Properties of radioactive elements"; Paneth, F. A., "Chemical aspects of the preparation of radioactive tracers"; Cook, G. B., "The chemistry of the production of radioactive elements"; Dunworth, J. V., "The measurement of radioactivity"; Taylor, D., "Electronic counting equipment"; Marley, W. G., "Applications in technical physics"; Chalmers, A. B., "Applications in metallurgy."

539.16 : 539.215.4 1035

Radioactivity and granular composition of soil. SIZOO, G. J., AND HOOGTEIJLING, P. J. *Physica, 's Grav.*, **13**, 517–28 (*Nov.*, 1947).—The content of radioactive material as well as the granular composition of 12 samples from the bottom of the Zuiderzee was determined. The radioactivity increases regularly with the percentage of fine material (grain size $< 50\ \mu$) and also with the specific surface of the mineral part of the material. There is no reason to believe that the presence of radioactive elements is restricted to a special grain size fraction of the fine material. It is suggested that the detected correlation may be connected with a preference of special minerals (e.g. zircon) for the smaller grain sizes. A.

539.16 : 539.215.4 1036

Radioactivity of the bottom of the Ijselmeer (Zuiderzee).

SIZOO, G. J., AND HOOGTEIJLING, P. J. *Physica, 's Grav.*, **13**, 561–70 (*Nov.*, 1947).—The activities of 60 specimens originating from the three upper layers (depth 0–15 m) of the south-western part, viz. the young marine clay, the old marine clay and the old holocene deposit, are measured. For samples taken from the same depth, the activity increases with the amount of fine material. For samples with the same amount of fine material the activities increase regularly with the depth within the upper part of the first layer, but show marked differences between successive layers. The increase of the activity for equal fineness with the depth within the upper part of the young marine clay, can be explained by the formation of Ra from its parents if at the time of deposition the Ra/U ratio was smaller than the radioactive equilibrium value. The disturbance of equilibrium decreases with the fineness of the material. It is suggested that this disturbance is due to the differences in the solubility and in the adsorbability of the various radioactive elements and their compounds. A.

539.16.08 : 548.0 1037

Crystals as detectors of nuclear radiation. *Electronics*, **20**, 144 (*Dec.*, 1947).—Tests with γ-rays and α-particles show that diamonds, when mounted between brass electrodes and subjected to a p.d. of 1 000 V, can substitute for G.M. counter tubes, an $\frac{1}{8}$-in stone providing about the same sensitivity. The wide spaces in the crystal lattice permit dislodged electrons to attain high velocities, resulting in considerable subsequent dislodgment of further electrons. Selected industrial diamonds, clear and free from faults, are suitable for this application. They cost much the same as G.M. tubes, have a longer life, and can be used to explore small spaces. Ancillary equipment is unchanged. H. G. M. S.

539.16.08 : 621.318.572 = 5 1038

The recording of coincidences with short time intervals. CONVERSI, M., AND PICCIONI, O. *Nuovo Cim.*, **1**, 279–90 (*June*, 1943) *In Italian.*—[Abstr. 940 B (1948)].

539.163 : 539.172.11 *see Abstr.* 1065

539.163 : 550.367 *see Abstr.* 1122

539.163.1 1039

Multiple nuclear isomerism. DER MATEOSIAN, E., GOLDHABER, M., MUEHLHAUSE, C. O., AND MCKEOWN, M. *Phys. Rev.*, **72**, 1271–2 (*Dec.* 15, 1947).—The 1·3-min and 21-min activities of Sb are shown to be isomers of the 60-day Sb^{124}, and the 3·5-min activity an isomer of the 2·8-day Sb^{122}. Decay schemes are proposed for Sb^{122} and Sb^{124}. W. E. D.

539.163.1.08 1040

An electrical method for the determination of short-period activities and its use in the evaluation of the half-life of ^{12}B. JELLEY, J. V., AND PAUL, E. B. *Proc. Camb. Phil. Soc.*, **44**, *Pt I*, 133–9 (1948).—The method consists in the production of neutrons by deuteron bombardment in a high-voltage accelerating tube, and using these neutrons to induce activities in various materials. The deuteron beam was switched on to or off the target by application of voltage pulses to electric deflecting plates. The induced activities were measured by a counter whose output was recorded in separate channels operating at definite times after irradiation. The periods were determined by varying the delay of the channel operation. The $\frac{1}{2}$-life of B^{12} was found to be 27 $\pm$ 2 msec. The reaction $N^{15}(n, \alpha)\,B^{12}$ was detected. L. S. G.

539.163.2 1041

Radiations from uranium (239) and neptunium (239). FEATHER, N. *Nature, Lond.*, **160**, 749 (*Nov.* 29, 1947).—It is pointed out that there is no evidence for the emission of an 870-keV γ-ray with anything like the same f quency as the 73-keV γ-ray in the disintegration U^{239} [Abstr. 722 (1948)] so that Slätis' interpretation the double β-ray spectrum is wrong. The author repo measurements by the absorption method [Abstr. 4 (1938)] on Np^{239}, which gave four β-spectra roug agreeing with those observed by Slätis.

539.163.2 1(

The β-radiations of antimony^{124}, tantalum^{182}, tu sten^{185}, and iridium^{192}. JNANANANDA, S. *Phys. Re* **72**, 1124–5 (*Dec.* 1, 1947).—Maximum energies are gi for the β-rays from these four isotopes. W. E.

539.163.2 1(

Search for positron-electron branching in certain b emitting isotopes. BARBER, W. C. *Phys. Rev.*, **72**, 115 (*Dec.* 15, 1947).—The β-rays emitted by the isoto Ga^{70}, As^{76}, Br^{80}, Br^{82}, Rb^{86}, Rh^{104}, Ag^{108}, In^{116}, Sb^{1} Sb^{124}, I^{128}, Re^{186}, and Au^{198} have been examined f positrons by the "trochoidal" method of Thiba [Abstr. 3020 (1934)]. Br^{80} is the only one found to e positrons as well as electrons. In studying Rb, a n activity of about 40-day $\frac{1}{2}$-life was found.

539.163.2 10

Further studies on the radiations from Ba^{131} and Cs^{1} FINKLE, B. J. *Phys. Rev.*, **72**, 1260–1 (*Dec.* 15, 1947). No evidence is obtained for positron emission fro 12-day Ba^{131} or 10·2-day Cs^{131}. W. E.

539.163.2 10

Production and properties of a long-lived radio-isoto of element 43. MOTTA, E. E., BOYD, G. E., AND LARSO Q. V. *Phys. Rev.*, **72**, 1270 (*Dec.* 15, 1947).—Th isotope emits a β-particle of max. energy 0·32 MeV a no γ-ray energy $> 0{\cdot}1$ MeV. Several chemical pr perties are listed. [See Abstr. 1033 (1948)]. W. E.

539.163.2 10

A new isotope of tungsten. WILKINSON, G. *Natu Lond.*, **160**, 864–5 (*Dec.* 20, 1947).—A 140-day W isoto was separated from Ta after bombardment with 20-M deuterons. It emitted X-rays identified as *L* and *K* X-rays, and small quantities (0·02 and 0·01 respective of the X-rays) of 70-keV electrons and 1·83-MeV γ-ra The activity is ascribed to electron capture by W^{1} and subsequent much more rapid decay of the excit Ta^{181} nucleus, with emission of a completely convert 140-keV and the 1·83-MeV γ-rays. [See Abstr. 9 (1947)].

539.163.2 = 5 10

On X-rays and gamma-rays emitted by Rh^{10}_{4}. CACCIAPUOTI, B. N. *Nuovo Cim.*, **4**, 31–8 (*Feb.*, 1947) *Italian.*—Absorption curves in Al, Ag and Pb of the ra from 44-sec Rh^{104} (Rh bombarded with slow neutron show that these rays mainly originate by a Bremsstrahlu process from the disintegration electrons of Rh. Th X-ray wavelength is 0·6 Å, which may be the characteris line of Rh.

539.163.2 : 539.155.2 10

New barium and cesium isotopes: 12.0d Ba^{131}, 10. Cs^{131}, and long-lived Ba^{133}. KATCOFF, S. *Phys. Rev.*, 7 1160–4 (*Dec.* 15, 1947).—A new Ba–Cs chain of probab mass assignment of 131 has been formed by neutr activation of Ba. The Ba^{131} isotope decays predomi antly by orbital electron capture with a $\frac{1}{2}$-life of 12·0 emitting γ-radiations of $\sim$ 0·26, 0·5, and 1·2 Me (the latter in low intensity). Detected also were 31-ke X-rays and 0·42 and 0·24-MeV conversion electron The Cs^{131} decays exclusively by *K*-electron capture wi a $\frac{1}{2}$-life of 10·2 d, emitting no detected γ-rays. Th Ba^{133} has a minimum $\frac{1}{2}$-life of 20 yr and is very probab the lower state to which the 37·8-hr Ba^{133} decays. Th

ıer decays by *K*-capture and emits 31-keV X-rays, ·MeV γ-rays, 0·34-MeV conversion electrons, and ·ibly 4·3-keV X-rays. A.

163.2 : 539.165.2 *see Abstr.* 1052–3

163.2 : 545.8 1049

ıternally converted radiation from europium, hafnium, osmium. CORK, J. M., SHREFFLER, R. G., AND VLER, C. M. *Phys. Rev.*, **72**, 1209–11 (*Dec.* 15, 1947). he following γ-ray energies were measured by use of ·icircular focusing magnetic spectrometers, together ı absorption methods: Eu^{154}, 122·4, 342·8, 407·8, 30; Hf^{181}, 132·5, 345·5, 478·7, 600 (by absorption); $^{93}_{\alpha}$ 129·1 keV. Two cases are shown where photo- trons and conversion electrons from the same γ-ray of comparable intensity. The ability of the radio- ve method in chemical analysis to show traces of ›urities is demonstrated. A.

.164.08 : 537.542 *see Abstr.* 985

.164.75 : 537.534.75 : 539.185.08 1050

The stopping power of polythene and fast neutron flux asurements. WILKINSON, D. H. *Proc. Camb. Phil. ·.*, **44** (*Pt I*) 114–23 (1948).—A method for measuring t neutron flux depends on the counting of protons ·jected by neutrons from a film of polythene [Abstr. 79 (1948)]. It is necessary to know the range-energy ıtion for protons in polythene; this was determined using the 5·3-MeV α-particles of Po. The α-particle ›pping powers of ethylene and polythene were asured for all energies from 0 to 5·3 MeV, and the ss stopping power identity was demonstrated in this ıge. L. S. G.

).165 : 537.533.92 1051

Primary ionization of β-particles in alcohol vapour and ɣon. CURRAN, S. C., AND REID, J. M. *Nature, Lond.*, **0**, 866 (*Dec.* 20, 1947).—This was measured by Graf's ·thod [Abstr. 1103 (1940)]; the efficiency of a counter ed with the gas was measured by observing the ·incidence rate with a second counter arranged to ›ept only β-rays passing through the first. The values tained for 0·42-MeV β-rays were: alcohol, 79·0, ɣon, 29·8 ion pairs/cm. The former is much higher ın the value calculated by Hazen [Abstr. 1699 (1943)].

9.165.2 : 539.163.2 1052

Coincidence measurements. I. Beta spectra. WIEDEN- CK, M. L., AND CHU, K. Y. *Phys. Rev.*, **72**, 1164–70 ·ec. 15, 1947).—The necessary and sufficient conditions r a simple β spectrum (not accompanied by internally- nverted γ-radiation) are discussed. It is generally nsidered that the $\beta - \gamma$ coincidence rate per recorded particle decreases with an increase of absorber thickness r a complex β spectrum. Although this is the most ·mmon condition, it is possible for the ratio to remain ›nstant or even rise as the β absorber thickness is ·creased. The ratio, $N_{\beta\gamma}/N_{\beta}$, is also calculated for nple spectra followed by non-delayed conversion ·ctrons as well as for conversion in metastable levels of ·etime $\geqslant$ the resolving time of the coincidence circuit. ata have been obtained for several nuclei including ^{124} (60 d), Cs^{134} (1·7 yr), Eu^{154} (5–8 yr), Au^{198} (2·7 d), ^{181} (55 d), $Ir^{192, 194}$ (60 d), $Hg^{203, 205}$ (51·5 d), Os^{193} 7 d), and K^{42} (12·4 hr). A.

9.165.2 : 539.163.2 1053

Coincidence measurements. II. Internal conversion. /IEDENBECK, M. L., AND CHU, K. Y. *Phys. Rev.*, **72**, 171–5 (*Dec.* 15, 1947).—It has been found that for a ıcleus which has a simple β spectrum followed by ternally-converted γ-radiation, the total absolute ›nversion coefficient can be obtained simply from single counting and coincidence rates. The method is inde- pendent of source strength, solid angle of counters, and counting efficiencies. The procedure could also be applied to processes involving complex β-decay if the branching ratio were known. The shape of the curve relating the (β-particle) – (conversion electron) co- incidences per observed β-particle to the absorber thickness is dependent upon the relative energies of the β-particle and the conversion electrons as well as upon the conversion coefficient α. The conversion coefficients have been obtained for Au^{198}, Cs^{134}, and $Ir^{192, 194}$. A.

539.166 : 539.172.11 *see Abstr.* 1066

539.166.08 : 548.0 1054

Thallium halide crystal counter. HOFSTADTER, R. *Phys. Rev.*, **72**, 1120–1 (*Dec.* 1, 1947).—A polycrystalline bromide/iodide preparation, after suitable heat treatment and annealing, responded to γ-rays when held at liquid N temps., in a manner similar to that of the Ag halides. Larger responses are expected from single crystals. W. E. D.

539.166.08 : 548.0 : 537.529 1055

Effects of space charge on the detection of high energy particles by means of silver chloride crystal counters. WOUTERS, L. F., AND CHRISTIAN, R. S. *Phys. Rev.*, **72**, 1127–8 (*Dec.* 1, 1947).—Using AgCl crystals at liquid N temps., it was found that the size of the pulses produced by radiation decreased with the number of pulses. This trouble is overcome by temporarily reversing the applied potential after each thousand counts. W. E. D.

539.166.75 1056

The absorption of gamma-rays from Co^{60}. MAYNEORD, W. V., AND CIPRIANI, A. J. *Canad. J. Res. A*, **25**, 303–14 (*Nov.*, 1947).—The γ-rays from Co^{60} are approximately monochromatic and are therefore suitable for testing theoretical absorption formulae. The absorption coefficient per electron for materials of atomic number $\leqslant$ that of Al was in agreement with the Klein–Nishina formula, assuming the Co radiation to consist of two lines at 1·10 and 1·30 MeV respectively. The photo- electric absorption coefficients per electron for heavy elements are in good agreement with the theory developed by Hulme, McDougall, Buckingham, and Fowler. This coefficient varies approximately as $Z^{3\cdot5}$. A.

539.166.835 : 537.12 = 5 1057

On electron pairs created by γ-rays in the presence of an electron. BORSELLINO, A. *Nuovo Cim.*, **4**, 112–30 (*June*, 1947) *In Italian.*—See Abstr. 666, 2230–1 (1947). The cross-section for pair production is calculated. As this process is possible for a photon energy $h\nu \geqslant 4\,mc^2$ it is necessary to use the relativistic approximation. The differential cross-section is calculated with the Dirac theory in Born's approximation, assuming as interaction energy the expression of Möller, which takes the retardation of potential and the spin interaction into account; the energy subtracted by the recoil electron is not neglected. The total cross-section is then calculated exactly and, besides its numerical values, expressions obtained for the extreme cases of low energy and very high energy are reported. A.

539.167.3 : 539.185.9 1058

Relative cross sections of reactions induced by high energy neutrons in C, N, O and F. KNOX, W. J. *Phys. Rev.*, **72**, 1254–5 (*Dec.* 15, 1947).—The relative cross- sections are given for the production of one or more of the isotopes C^{11}, N^{13}, O^{15}, F^{17}, F^{18} when C, N, O or F is bombarded with high energy neutrons ($\sim$ 90 MeV). W. E. D.

539.17 1059

The dynamics of nuclear reactions. MANDEVILLE, C. E.

J. Franklin Inst., **244**, 385–99 (*Nov.*, 1947).—Various fairly standard calculations on straggling and on conversion from laboratory to centre-of-mass co-ordinates are presented. A. P. F.

539.17 : 537.591.1 *see Abstr.* 992

539.172 1060

A photographic apparatus for angular-distribution measurements. RUBIN, S. *Phys. Rev.*, **72**, 1176–86 (*Dec.* 15, 1947).—A scattering camera was designed and constructed to measure the angular distribution of heavy charged particles emitted from nuclear reactions by means of the tracks which they produce in a photographic emulsion. It uses a single 2 in × 4 in plate parallel to the beam to detect particles emitted in the angular range of 25° to 160° to the direction of the incident beam of bombarding particles. The camera has been used to investigate the angular distribution of the α-particles from $Li^7(p,\alpha)\alpha$, the long-range α-particles from $F^{19}(p,\alpha)O^{16}$, and the resonance scattering of protons in $Be^9(p,\gamma)B^{10}$. These reactions have been investigated over bombarding proton energies covering the range of interest in each reaction. This apparatus has been found to be effective for detailed measurements of angular distributions, with very high resolution of energy and of angle, even for reactions with very low yield, using thin solid targets. Fogging of the plates by soft X-rays from the target has been reduced by suitable target supports. Some results and conclusions concerning the above reactions are reported. A.

539.172 1061

On the tripartition of heavy elements. TSIEN, S.-T. *Phys. Rev.*, **72**, 1257–8 (*Dec.* 15, 1947).—The main experimental facts are explained with a simplified model for tripartition, viz. the yield, the max. range of the light fragment and its angle of emission. It is further shown that its ratio $A/Z \geqslant 2$, thus excluding H^1 and H^3. [Fig. 1 (but not caption) is printed in error on p. 1265. The diagram on the left should be marked "A", that on the right, "B".] W. E. D.

539.172 = 5 1062

Disintegration of Be^9 by fast electron collision. CALDIROLA, P. *Nuovo Cim.*, **4**, 39–51 (*Feb.*, 1947) *In Italian.*—A calculation is made of the cross-section for disintegration. The nucleus Be^9 may be treated schematically as if the neutron, whose binding energy is very small, were moving in the field of a narrow potential well. The transitions producing the nuclear disintegration are due to the electric moment and to the magnetic moment of the system: the theory therefore predicts that the magnetic transition can be neglected for energies not too much above the threshold. Finally, the dependence of the cross-section for disintegration on the energy of the incident electron is numerically evaluated: the results are in agreement with the experimental values obtained by Wiedenbeck [Abstr. 1690 (1946)]. A.

539.172.11 1063

Alpha–2 neutrons nuclear reactions. LARK-HOROVITZ, K., RISSER, J. R., AND SMITH, R. N. *Phys. Rev.*, **72**, 1117 (*Dec.* 1, 1947).—18-MeV α-rays produced 3·4-hr Cu^{61} activity in Co, and ~ 40-day Ag^{105} activity in Rh, indicating $(\alpha, 2n)$ reactions. 15-MeV α-ray bombardment of V, Co, Cu, Ga, As, Rb, Y, Rh, Ag, In and I had previously shown no evidence of $(\alpha, 2n)$ reactions, though the following were found: $Ga^{69}(\alpha, n)\ As^{72}$ (26 hr); $Ga^{71}(\alpha, n)\ As^{74}$ (16 day); $Rb^{87}(\alpha, n)\ Y^{90}$ (60 hr); $I^{127}(\alpha, n)$, Cs^{130} (30 min).

539.172.11 1064

The relative yields of (α, n) and $(\alpha, 2n)$ reactions for Ag and Rh with 15–20-MeV alpha-particles. BRADT, H. L., AND TENDAM, D. J. *Phys. Rev.*, **72**, 1117–1 (*Dec.* 1, 1947).—These are plotted against excess α-ra energy and compared with theoretical curves. Th excitation curves for the three reactions with Rh ar given, the threshold for the $Rh^{103}(\alpha, 2n)\ Ag^{105}$ reactio being 16·2 ± 0·5 MeV. [Note: Figure numbers an captions for the diagrams should be interchanged.] W. E. D

539.172.11 : 539.163 106

The radioactive indium isotopes of mass numbers 11 and 112. TENDAM, D. J., AND BRADT, H. L. *Phys. Rev.*, **72**, 1118–19 (*Dec.* 1, 1947).—Bombardment of Ag with 15–20-MeV α-particles produces 4 periods all identifie with In. The 66-min and 23-min activities are assigne to the respective reactions, $Ag^{107,\ 109}(\alpha, n)\ In^{110,\ 112}$, an the 2·7-day activity to $Ag^{109}(\alpha, 2n)\ In^{111}$ which has threshold at 15·5 ± 0·5 MeV. Decay schemes ar proposed for In^{111} and In^{112}. W. E. D

539.172.11 : 539.166 106

Gamma-rays from the alpha-particle bombardment o Na, Mg, Al, Si, P, S. POLLARD, E., AND ALBURGER D. E. *Phys. Rev.*, **72**, 1196–201 (*Dec.* 15, 1947).—Na Mg, Al, Si, P, S targets have been bombarded by 7·2 MeV He ions. The emission of γ-radiation has been observed Pb absorption coefficients were obtained in all cases The values lie close to the minimum of the Pb absorptio curve. In the case of Al, absorption in Cu has bee measured and, in addition, absorption of Compton recoi electrons by Al has been measured by a coincidenc method. The results show that a γ-ray of energy 3·5 ± 0·3 MeV is present. This agrees with a transitio from the Q_2 to Q_0 state observed in the $Al^{27}(\alpha, p)Si^3$ reaction. Unequivocal energy assignments cannot b made for the remaining reactions. However, Pb absorp tion experiments indicate the following probable values S, 1·6 ± 0·3; Mg, 3·2 ± 0·6; Na, 2·3 ± 0·3 MeV The values for elements Si and P cannot be assigned unti it is clear whether the absorption is above or below th minimum. Pb absorption coefficients are given. Sinc the γ-ray energies are generally > the difference betwee energy levels obtained from other information, it is likel that in these cases direct transitions are preferred t cascade. A

539.172.3 106

Relative yields of (γ, n) reactions. PERLMAN, M. L AND FRIEDLANDER, G. *Phys. Rev.*, **72**, 1272 (*Dec.* 1 1947).—Yields for 15 nuclei between C^{12} and Re^{187} ar listed for X-rays of max. energies of 50 MeV an 100 MeV. W. E. D

539.172.4 106

The yield of ^{139}Ba in the fission of natural uranium b fast and slow neutrons. BRODA, E., KOWARSKI, L., AN WEST, D. *Proc. Camb. Phil. Soc.*, **44** (*Pt I*) 124–3 (1948).—The yields by neutrons from a mixed Ra–B source and by C-group neutrons were compared. Th fission rates, measured with an ionization chamber, wer correlated with the β-ray activity of Ba^{139}, chemicall extracted from a mass of U_3O_8 exposed to an identica neutron spectrum. The ratio of the two fission yields i 0·84 ± 0·03. The possibility of using Ba^{139} as a loca or integrating indicator of fission in extended uraniferou media is discussed. L. S. G

539.172.4 106

The capture of neutrons by deuterons. BURHOP, E. H. S AND MASSEY, H. S. W. *Proc. Roy. Soc. A*, **192**, 156–6 (*Feb.* 4, 1948).—The cross-sections for capture of neutron by deuterons, involving emission of both electric an magnetic dipole radiation, are calculated using the wav functions obtained by Buckingham and Massey [Abst

(1941)] in the course of an application of the ıating-group structure method to the elastic scatter- of neutrons by deuterons. The value found for ıre of neutrons with emission of magnetic dipole ıtion is found to be very sensitive to the particular taken for the various wave functions, owing to a high degree of cancellation that occurs in the grations. As a result it is out of the question at ent to provide accurate theoretical values for this ess. All that can be said is that the cross-section for ıre of thermal neutrons by deuterons is likely to be ormally small. It may well be 10^{-28} cm² or less. is in general agreement with observation. For ure of fast neutrons with emission of electric dipole ıtion there is much less uncertainty in the calculated es although the cross-sections are very small, of the r of a few times 10^{-29} cm². The actual value of the s-section in this case depends on the assumed type ucleonic interaction, i.e. whether it is of exchange acter or not. Results are also given for the inverse ess—the photodisintegration of the triton. A.

172.4 : 530.162 1070

he uncertainty principle and the yield of nuclei formed ssion. Gast, P. F. *Phys. Rev.*, **72**, 1265 (*Dec.* 15, 7).—The curve giving yield of fission products against s explained entirely on the uncertainty principle. ; 1 (but not caption) is printed in error on p. 1257.] W. E. D.

172.4 : 539.155.2 *see Abstr.* 1033

172.4 : 614.8 *see Abstr.* 1135

18 : 530.14 *see Abstr.* 823

18 : 537.591 1071

vidence for the existence of new unstable elementary ticles. Rochester, G. D., and Butler, C. C. *ure, Lond.*, **160**, 855–7 (*Dec.* 20, 1947).—Two cloud- mber photographs of penetrating showers under Pb claimed to demonstrate the spontaneous transforma- of (*a*) a new type of uncharged elementary particle, mass between 770 *m* and 1 600 *m* (*m* = electron s), into lighter charged particles; (*b*) a new type of rged particle, of mass $> 980\,m$ and $<$ that of a ton, into two light particles, one charged and the er uncharged. The decay constant of the particles is ghly estimated to be $\sim 5\times10^{-8}$ sec.

18 : 537.591 = 5 1072

On the absorption and disintegration of mesons at the of their path. Conversi, M., Pancini, E., and cioni, O. *Nuovo Cim.*, **3**, 372–90 (*Dec.*, 1946) *In lian.*—See Abstr. 1313 (1947) for English version.

18 : 539.15 = 5 1073

On the disintegration of a meson in a bound state. rinaldesi, E. *Nuovo Cim.*, **4**, 131–8 (*June*, 1947) *In lian.*—The decay of a pseudoscalar meson in an mic meson-shell, particularly in a *K* meson-shell, the spectrum of the electrons emitted in such a cess are studied. The width of the spectral line is an reasing function of the atomic number *Z*. Numerical ults for $Z = 6$ are summarized. A.

181 : 539.615 : 539.153 *see Abstr.* 1030

185 = 5 1074

Distribution of neutrons from a point source of fast trons in an infinite hydrogenous medium. II. Thermal trons. Verde, M. *Nuovo Cim.*, **4**, 24–30 (*Feb.*, 7) *In Italian.*—The theroretical stationary distribution btained, and compared in curves with experimental ults. Agreement with that for 3·5-MeV primary trons in water is satisfactory, but with that for mary neutrons from D + B is not so good, because of neglect of the soft primary component. The asymptotic behaviour of the distribution at great distances is $e^{-\lambda_0 r}/r$ as in the case of fast neutrons. A.

539.185 : 530.14 *see Abstr.* 824

539.185 : 537.122 1075

On the interaction between neutrons and electrons. Fermi, E., and Marshall, L. *Phys. Rev.*, **72**, 1139–46 (*Dec.* 15, 1947).—The possible existence of a potential interaction between neutron and electron has been investigated by examining the asymmetry of thermal neutron scattering from Xe. The scattering in the centre-of-gravity system shows exceedingly little asymmetry. By assuming an interaction of a range equal to the classical electron radius, the depth of the potential well has been found to be $300 \pm 5\,000$ eV. This result is compared with estimates based on the meson theory according to which the depth should be 12 keV. It is concluded that the interaction $\not>$ that expected from the meson theory; that, however, no definite contradiction of the meson theory can be drawn at present, partly because of the possibility that the experimental error may have been underestimated, and partly because of the indefiniteness of the theories which makes the theoretical estimate uncertain. A.

539.185 : 537.122 1076

Interaction of neutrons with electrons. Jauch, J. M., and Watson, K. *Phys. Rev.*, **72**, 1254 (*Dec.* 15, 1947); *erratum*, **73**, 268 (*Feb.* 1, 1948).—Calculations on the meson theory lead to a scattering cross-section of low energy neutrons with electrons of $\sim 10^{-35}$ cm². W. E. D.

539.185 : 539.152.1 1077

Scattering of slow neutrons by ortho- and parahydrogen. Sutton, R. B., Hall, T., Anderson, E. E., Bridge, H. S., DeWire, J. W., Lavatelli, L. S., Long, E. A., Snyder, T., and Williams, R. W. *Phys. Rev.*, **72**, 1147–56 (*Dec.* 15, 1947).—Measurements have been made for neutrons of energies in the range 10–30°K. Using the Schwinger–Teller theory the results have been correlated with the scattering cross-section of free protons for slow neutrons and with the range of a square-well $n-p$ potential. The measured cross-sections show the energy-dependence expected from the theory; they imply a free proton cross-section of $19{\cdot}7\times10^{-24}$ cm² and a force range of $1{\cdot}5\times10^{-13}$ cm, the first value agreeing within experimental error with the accepted figure, but the second falling significantly below the result $2{\cdot}8\times10^{-13}$ cm obtained [Abstr. 3012 (1939)] for the $p-p$ force. The singlet state of the deuteron is again shown to be virtual, and the possibility of a neutron spin of $\frac{3}{2}$ is eliminated since the data in this case would imply a free proton cross-section of only 7×10^{-24} cm². A.

539.185 : 539.152.1 *see Abstr.* 1022

539.185.08 1078

Calibration of a Ra + Be neutron source by the B(n, α)Li reaction. Seidl, F. G. P., and Harris, S. P. *Rev. Sci. Instrum.*, **18**, 897–9 (*Dec.*, 1947).—A method has been developed for determining absolute numbers of neutrons in terms of He production in the B(n, α)Li reaction. Preliminary measurements are reported of the number of neutrons emitted/sec from a certain Ra + Be source which contains 504 millicuries of Ra; it was found to emit $(5{\cdot}5 \pm 0{\cdot}4)\times10^6$ neutrons/sec. A.

539.185.08 1079

A coincidence method of measuring a flux of fast neutrons. Kinsey, B. B., Cohen, S. G., and Dainty, J. *Proc. Camb. Phil. Soc.*, **44** (*Pt 1*) 96–113 (1948).—In the method described, the rate at which fast neutrons cross

unit area is measured by counting protons projected into a small solid angle in the forward direction from thin and thick layers of polythene. The protons are detected by triple coincidences between 3 proportional counters. The method applies to neutrons of energies from 1 MeV upwards, and may be used in the presence of intense γ-rays. The angular distribution of fast neutrons produced by a deuteron — deuterium source was measured by the coincidence method, and the values agree to within 10% with those obtained by Bretscher and French using the ionization chamber. [See Abstr. 1050 (1948)]. L. S. G.

539.185.08 : 537.534.75 : 539.164.75 *see Abstr.* 1050

539.185.7 1080

Preliminary data on absorption of high energy neutrons from the 184-inch cyclotron. HILDEBRAND, R., AND MOYER, B. J. *Phys. Rev.*, **72,** 1258–60 (*Dec.* 15, 1947).—Half-value thicknesses for the absorption of neutrons of $\sim$ 90 MeV are given for a number of substances. Their $\frac{1}{2}$-values vary from $\sim$ 55 cm for water and paraffin to $\sim$ 24 cm for Pb and concrete, and down to $\sim$ 16 cm for Cu. W. E. D.

539.185.7 1081

Total cross sections of nuclei for 90-Mev neutrons. COOK, L. J., MCMILLAN, E. M., PETERSON, J. M., AND SEWELL, D. C. *Phys. Rev.*, **72,** 1264–5 (*Dec.* 15, 1947).—The total cross-section was measured for 15 elements, and varies from $0{\cdot}083\times10^{-24}$ cm² for H to $5{\cdot}03\times10^{-24}$ cm² for U. An empirical formula is given which fits these results. W. E. D.

539.185.9 : 539.167.3 *see Abstr.* 1058

STRUCTURE OF SOLIDS 539.2

539.215.4 : 539.16 *see Abstr.* 1035–6

539.216.1 : 666 : 539.32 *see Abstr.* 1090

539.217.5 : 534.845 *see Abstr.* 901

539.23 : 532.516 *see Abstr.* 829

539.234 : 537.311.33.096 *see Abstr.* 969

539.264 : 678 1082

On the degree of crystallinity in natural rubber. I. An improved method to determine the degree of crystallization in rubber. GOPPEL, J. M. *Appl. Sci. Res.*, **A1** (*No.* 1) 3–17 (1947).—Earlier results, particularly by Field [Abstr. 398 B (1941)] are discussed and criticized. An improved X-ray method for quantitative determination of the crystallization under different degrees and rates of stretching is here described.

539.264 : 678 1083

On the degree of crystallinity in natural rubber. II. The orientation of the rubber crystallites in stretched samples. GOPPEL, J. M. *Appl. Sci. Res.*, **A1** (*No.* 1) 18–26 (1947).—A complication due to varying crystallite orientation in different samples appeared to interfere with the application. A simple relation is given here between the degree of orientation and an empirical constant which makes possible a rapid determination of the degree of crystallization, regardless of the orientation in the sample under investigation. A.

539.264 : 678 1084

The molecular structure and arrangement in stretched natural rubber. FISHER, D. G. *Proc. Phys. Soc., Lond.*, **60,** 99–113 (*Jan.*, 1948).—Thin films of stretched rubber yield electron diffraction patterns which exhibit, in addition to the Laue spots, a pattern of diffuse zones. Finch and Wilman [Abstr. 4806 (1937)] obtained similar composite patterns from various organic crystals and, with Charlesby [Abstr. 2224 (1939)], they showed that in the case of anthracene the diffuse zone pattern ow its origin to molecules in the crystal, but was similar that which would be obtained by scattering from dependent molecules oriented as in the crystal. T present study has demonstrated that this is also true the case of rubber.

ELASTICITY . STRENGTH . RHEOLOGY 539.3

539.31 10

Non-linear viscous elasticity and the Eyring she model. HALSEY, G. *J. Appl. Phys.*, **18,** 1072–97 (*De* 1947).—The theoretical parts of a previous series papers (refs. listed) are represented in summarized a clarified form. It is shown that the simple 3-eleme model (2 springs in parallel, with a dashpot in series) f the explanation of stress-strain time phenomena textile fibres is often adequate for more compl behaviour if non-Hookean laws for the springs and no Newtonian for the viscous element, are postulate Further, any system so far investigated shows, over long enough period, a number or a distribution relaxation times. The paper continues with a discussi of: six rules for analysing stress-strain curves; t thixotropic viscous element; constant-force springs.

539.31 : 534.37 10

Mechanical behavior of high damping metals. ZENE C. *J. Appl. Phys.*, **18,** 1022–5 (*Nov.*, 1947).—T relation between the various measures of internal frictic are independent of the precise mechanism of the dissip tion of energy when the internal friction is small, but n when it is large. In this paper the relation between t two measures most commonly used, logarithmic decr ment and tangent of the angle with which strain la behind stress, is deduced for all levels of internal frictic in the important case in which the dissipation of ener is due to a relaxation process having a single time relaxation. The conditions are further derived und which a specimen of such a metal will not vibrate, b returns aperiodically to its equilibrium configuration.

539.31 : 535.551 : 678 10

Stresses and birefringence in rubber subjected to gener homogeneous strain. TRELOAR, L. R. G. *Proc. Phy Soc., Lond.*, **60,** 132–41 (*Feb.*, 1948).—A method described by which a sheet of rubber may be subjected t the most general type of homogeneous strain, wit simultaneous measurement of the principal stresses an the birefringence. As predicted by the molecular networ theory, the birefringence is found to $\propto$ (*a*) the differenc of the squares of the principal extension ratios, (*b*) th difference of the principal stresses in the sheet. A examination of the stresses shows that these cannot b accurately represented by the equations derived from th network theory. A closer approximation is given by more general theory of Mooney, the simplest form which gives a satisfactory account of the behaviour of swollen rubber. For a dry rubber, on the other hanc the Mooney formula, though better than the networ theory, does not adequately represent the experiment data.

539.31 : 539.11 *see Abstr.* 1016

539.31 : 548.0 10

Third-order elastic coefficients of crystals. BHAGA VANTAM, S., AND SURYANARAYANA, D. *Nature, Lond* **160,** 750–1 (*Nov.* 29, 1947).—The authors have extende their methods, based on group theory, of calculating th numbers of higher-order coefficients needed for th description of elastic behaviour of crystals of differer classes, to the case of finite strain. The total number

ficients required for each class is listed. In the case ubic crystals, they agree with those of Birch [Abstr. 2 (1947)] except that 6 is given instead of 8 in the lass; Birch's error is explained.

.31 : 548.7 1089

he behaviour of the lattice of polycrystalline iron in ion. Wood, W. A. *Proc. Roy. Soc. A*, **192**, 218–31 4, 1948).—The stress-strain characteristics have n investigated for two distinct types of lattice plane in imens of Swedish iron in tension. Earlier observa- is are confirmed that the metallic lattice under stress ses to conform with Hooke's law when external plastic ormation occurs, but the deviation differs in the two s. The elastic range for the (211) spacing appears to > for the (310) spacing. On removal of stress in ess of the "lattice yield," the two types of spacing w a residual strain of opposite sign to the strain under ss, but the magnitude is different. The residual in is attributed to the onset of internal stresses as a ult of plastic flow, and the difference in strain for the ferent types of plane to a difference in magnitude of internal stress for grains of different crystallographic entation. The internal stresses for both types of plane pear to consist of a longitudinal compression and a nsverse compression. These components should be lanced by equivalent regions in tension, but none so have been found. It may be necessary to conclude it such regions are in a state too disordered for coherent lection. A.

.32 : 534.372 : 621–752 : 534.833 *see Abstr.* 896

.32 : 539.216.1 : 666 1090

Physical problems raised by the glass fibre. Peychès, I. ém. Soc. Ing. Civ. France, **98**, 411–22 (1945).—A inly mathematical treatment of the behaviour of glass en formed into threads from the molten state through jet, by mechanical methods, centrifugal force, or by id flow. The filament-forming capacity is measured η (poises)/γ (dynes/cm), and it rises from 0·33 at 400° to 6·5 at 1 100° and 26 at 1 000°. A low temp. ves a fine filament, but a low throughput. The Young (Y) and rigidity (R) moduli of a glass filament both crease with a reduction in the fibre diameter (D); hen $D > \sim 30\,\mu$ the Poisson coeff. falls, indicating e development of anisotropic conditions. Thermal eatment of the filaments restores R and Y to the values aracteristic of glass in bulk. The flexing resistances f glass fibres of relatively high (0·1–0·8 mm) and low 0–80 μ) D, increase with increase in D linearly and as hyperbolic function, respectively. B. A.

39.32.08 : 532.122 : 541.182 : 534.614 1091

A sound velocity method for determining the compressibility of finely divided substances. Urick, R. J. *Appl. Phys.*, **18**, 983–7 (*Nov.*, 1947).—A method is resented whereby the adiabatic compressibility of a ely divided material can be found from sound velocity nd density measurements of a suspension of the particles a liquid. It is based on the assumption that the elocity of sound in a suspension is the same as it would e in an ideal solution of the two substances. This is erified experimentally by measurements on kaolin–water uspensions and xylene–water emulsions, and the method s illustrated by the determination of compressibility of he oil droplets in an oil emulsion and of the blood orpuscles in horse blood. Considerable accuracy is ttainable for materials which are not too incompressible ompared to the suspending liquid. A.

539.32.08 : 534.113 : 534.37 = 5 1092

Electro-acoustic method for experimental research on elasticity. Bordoni, P. G. *Nuovo Cim.*, **4**, 177–200 (*June*, 1947) *In Italian.*—Longitudinal waves are excited in a metal rod, and also detected, by a capacity electrode close to one end of the rod. The received signal is frequency modulated, and extraneous noise is filtered out so effectively that, in addition to larger vibrations satisfactory for determinations of elastic constants, vibrations as low as 0·1 Å can be detected. These can no longer be interpreted in the usual macroscopic way, but must be regarded as Brownian motion components. Some examples of the applications are given, e.g. the effect of small cavities on sound velocity of an Al bar. The damping due to air $\gg$ the internal damping, and this, together with the effect of mechanical supports, is discussed from a theoretical standpoint. A.

539.32.08 : 538.31 1093

On theory of a new method for determining Young's modulus. Talekar, V. L. *Curr. Sci.*, **16**, 337 (*Nov.*, 1947).—Proposes measurement of the change in radius of a current-carrying loop of wire on establishing a strong magnetic field perpendicular to the plane of the loop.

539.371 1094

Large elastic deformations of isotropic materials. I. Fundamental concepts. II. Some uniqueness theorems for pure, homogeneous deformation. Rivlin, R. S. *Philos. Trans. A* (*No.* 822) 459–508 (*Jan.* 13, 1948).—I. Components of strain and stress are defined in the case of large deformations; and a type of stress/strain relationship (called neo-Hookean elasticity) is studied in detail. Incompressibility of the material is assumed. This relationship is used as a basis for a theory of large elastic deformations, and it agrees with that obtained, for an ideal rubber-like material, from molecular statistical considerations. The stored energy formula is obtained, and the equations of motion are derived (by a variational method). These are given both in terms of the stress components and in terms of the stored energy function. The results are equivalent. II. The equilibrium of a cube under the action of 3 pairs of equal and opposite normal forces is studied. Various conditions are found in order that the equilibrium state be unique. L. S. G.

539.371 : 539.385 1095

Large elastic deformations of isotropic materials. III. Some simple problems in cylindrical polar co-ordinates. Rivlin, R. S. *Philos. Trans. A* (*No.* 823) 509–25 (*Feb.* 24, 1948).—General results obtained earlier [Abstr. 1094 (1948)] are specialized to the case of axial symmetry and applied to the simple torsion of a solid cylinder and of a hollow cylindrical tube and their combined simple extension and torsion. For a solid cylinder, simple torsion may be maintained by surface tractions consisting of a torsional couple and a compressive force applied to the ends of the cylinder. For a hollow cylindrical tube it is necessary to apply, in addition, a normal surface traction on one of the curved surfaces of the tube. L. S. G.

539.373 1096

Electron microscope and electron diffraction study of slip in metal crystals. Heidenreich, R. J., and Shockley, W. *J. Appl. Phys.*, **18**, 1029–31 (*Nov.*, 1947).—Investigation of pure Al crystals deformed by tension or compression led to the following conclusions: The initial slip occurs in a single (111) plane to a displacement of $\sim 2\,000$ Å; this particular plane then resists further motion, and slip begins anew on another (111) plane about 200 Å away. The process repeats and results in a laminar slip region which may merge with adjacent ones. The material between visible slip bands is relatively unaffected until the spacing of the bands is reduced to $\sim 5\,\mu$ (5% elongation). At higher deformations, rotation of the laminae is indicated.

539.374 : 539.4 : 536.48 1097

Experiments on the effect of low temperature on some plastic properties of metals. DRUYVESTEYN, M. J. *Appl. Sci. Res.*, **A 1** (*No.* 1) 66–80 (1947).—The yield value, breaking strength, elongation and hardness of a number of pure polycrystalline metals were measured at room temperature and at −183°C. The yield value is always higher at −183°C than at 20°, the difference being relatively small (< 75%) for the cubic face-centred and a number of hexagonal metals (e.g. Mg). This difference is large for the body-centred metals and for Zn, Cd and Sn. The former metals have a larger elongation at lower temperature, the latter, however, become more or less brittle at low temperature. The breaking strength and the hardness increase generally with decreasing temperature. A.

539.385 : 539.371 *see Abstr.* 1095

539.4 : 536.48 : 539.374 *see Abstr.* 1097

539.4.019.1 : 666 1098

Mechanism of fracture of glass and similar brittle solids. TAYLOR, N. W. *J. Appl. Phys.*, **18**, 943–55 (*Nov.*, 1947).—A theory is proposed which connects the stress, f, required to break a brittle material in simple tension, with its duration of application, t. The slow process preceding fracture is shown to be the orientation of the atomic network contained in an elementary prism of length $r = \lambda_0 E/f$ (E = Young's modulus, λ_0 = critical elongation required for fracture). The rate-controlling factor is the activation energy, $E\alpha/f$, for the orientation or rearrangement of the atomic network under the stress, f. Moisture on glass, and moisture plus oxygen on certain metals, are important catalytic or fatigue-promoting factors because they reduce the unit activation energy, α. The theory leads to the equation $\log t = -\log k_0 + (E\alpha/2{\cdot}3\,kT)/f$ [t = time for fracture (duration of the stress), k = Boltzmann constant, T = absolute temp., α and k_0 are experimentally determined constants.] This resembles the Glathart–Preston relation [Abstr. 1709 (1946)], which, in the case of glass, appears to be valid over a time factor of 10^7. The theory shows why a solid object does not have a single characteristic breaking strength, and how it adjusts its fracture mechanism to whatever stress is applied. Quantitative tests of the theory are made, using fracture data on various glasses and on one glass at various temperatures. Applicability of the theory to certain aspects of fatigue of metals under stress-corrosion conditions, as well as to failure by fracture of the more rigid organic plastics, is indicated. An equation, $E\lambda_0 = 2\gamma$, is proposed which connects Young's modulus and the critical fracture distance with the surface tension, γ, of the solid. Some examples a given.

539.42 : 531.252 10

The effective stress concentration at the end of a cra in materials having atomic constitution. GURNEY, *Phil. Mag.*, **39**, 71–6 (*Jan.*, 1948).—The crack is assum to have an elliptic form and the average stress over small area at the end of the major axis is compute This involves the ratio of the length to the radius curvature at the end of the crack, and the case in whi this ratio is approx. unity is of special interest, since practice the smallest radius of curvature and length a of the order of atomic dimensions. The effective str concentration is then ∼½ the maximum stress concent tion occurring at the line boundary of the hole. L. S.

539.501 : 537.226.1 : 541.182.6.025 *see Abstr.* 1103

539.53 11

Annealing temperature and hardness of tantalu GREENWOOD, J. N., AND MYERS, R. H. *Nature, Lon* **160**, 675 (*Nov.* 15, 1947).—Tantalum is hard and brit after heating to 1 800°C and cooling quickly, the ma mum hardness being dependent on the amount of previo cold working. It becomes soft again on heating 2 400°C and quickly cooling.

539.533 11

A simple theory of static and dynamic hardness. TABO D. *Proc. Roy. Soc. A*, **192**, 247–74 (*Feb.* 4, 1948). The last stage of the indentation of a softer metal surfa by a hard spherical indenter is elastic, and is found to reversible, repeatable and to conform to Hertz's equatio for the elastic deformation of spherical surfaces. T energy of elastic recovery accounts for the energy rebound of the indenter in dynamic hardness tes where, with soft metals, the dynamic hardness ≫ t static, it is suggested that quasi-viscous forces, depende on time, must be taken into account. It is sho experimentally that for a material incapable of appreciat work-hardening, the mean pressure P_m required produce plastic yielding is related to the elastic limit of the material by a relation $P_m = cY$, where c is constant having a value between 2·6 and 3. An e pirical method is described which takes into account t work-hardening produced in metals by the indentati process itself. This results in a general relation betwe hardness measurements and the stress-strain chara teristic of the metal, and there is close agreement betwe the theory and the observed results. In addition, t theory explains the empirical laws of Meyer.

539.89 : 532.122 : 535.324 *see Abstr.* 910

539.89 : 536.48 : 541.123 *see Abstr.* 1102

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

541.123 : 536.48 : 539.89 1102

Phase equilibria for a complex mixture—coal gas—at low temperatures and high pressures. CHOW, C. S. *Proc. Roy. Soc. A*, **192**, 340–63 (*Feb.* 18, 1948).

REACTION KINETICS 541.124/.128

541.126 : 534.222.2 *see Abstr.* 866

541.127.1 : 542.952 *see Abstr.* 1108

COLLOIDS . DISPERSE SYSTEMS 541.18/.182

541.18.025 : 532.137 *see Abstr.* 837

541.182 : 534.614 : 532.122 : 539.32.08 *see Abstr.* 1091

541.182.6.025 : 537/226.1 : 539.501 11

Dielectrics and rheology of non-aqueous dispersio VOET, A. *J. Phys. Coll. Chem.*, **51**, 1037–63 (*Sep* 1947).—Substantial changes of permittivity of dispersio in organic liquids may occur under the application shearing stresses, and these have been related both agglomeration and orientation. The permittivity can related to the shape of the particles. Plastic syste were found to exhibit a time effect, either in parti agglomeration or orientation or both, which might be t short to be detected rheologically. Thus plastic syste are always thixotropic.

ADSORPTION 541.183

541.183.57 11

The adsorption of direct dyes on cellulose. PETE

H., AND VICKERSTAFF, T. *Proc. Roy. Soc. A*, **192**, 2–308 (*Feb.* 4, 1948).

1.183.575 1105

Adsorption equilibria of liquid mixtures of carbon rachloride-methanol with charcoal. INNES, W. B., D ROWLEY, H. H. *J. Phys. Coll. Chem.*, **51**, 1172–81 *pt.*, 1947).

1.183.576 1106

Adsorption isotherms of mixed vapors of carbon tetra-oride and methanol on activated charcoal at 25°C. NES, W. B., AND ROWLEY, H. H. *J. Phys. Coll. Chem.*, 1154–71 (*Sept.*, 1947).

ATOMIC THEORY 541.2

1.24 : 532.13 : 541.64 *see Abstr.* 1107

CHEMICAL STRUCTURE 541.4/.6

1.57 : 537.226.8 : 539.132 *see Abstr.* 1019

1.57 : 539.132 *see Abstr.* 1018

1.57 : 539.132 = 3 *see Abstr.* 1020

1.57 : 539.133 : 535.341–15 *see Abstr.* 918

1.64 : 532.13 : 541.24 1107

Studies in polymerization. II. A method for investigating e relation between the molecular weights and intrinsic scosities of polymers, and its application to polystyrene. MFORD, C. H., AND DEWAR, M. J. S. *Proc. Roy. Soc.* **192**, 329–39 (*Feb.* 18, 1948).—See Abstr. 1108 (1948). simple method is described. Unbranched polystyrene found to obey Houwink's law with an exponent of 0·65. quations are given for calculating the number average egree of polymerization and molecular weight distribu-on in unfractionated polymers. It is pointed out that method is now available for the preparation of polymers ith known molecular weights and distribution. The osolute value of the velocity constant for the transfer action between styrene and carbon tetrachloride at 0°C is calculated. A.

1.64 : 539.13 : 532.7 *see Abstr.* 846

CHEMICAL PROCESSES 542.9

2.952 : 541.127.1 1108

Studies in polymerization. I. A method for determining e velocity constants in polymerization reactions and its pplication to styrene. BAMFORD, C. H., AND DEWAR, M. J. S. *Proc. Roy. Soc. A*, **192**, 309–28 (*Feb.* 18, 1948).—See Abstr. 1107 (1948).

CHEMICAL ANALYSIS 543/545

545.7 : 533.275 : 536.242 1109

Analysis of gas mixtures containing a para-electric component. SCHWARZ, N. *Appl. Sci. Res.*, **A 1** (*No.* 1) 47–54 (1947).—A method of gas analysis is described which makes use of the influence of an electric field on the heat transfer from a wire [Abstr. 952 (1948)]. The method, which is especially suited for the determination of the NH_3 content in mixtures with air and, under certain limitations, with H_2 and N_2, is fully automatic and continuous and can be made self-registering. A possible application to the measurement of humidity is briefly touched upon. A.

545.7 : 536.423.4 : 533.52 1110

An apparatus for micro gas analysis. KENTY, C., AND REUTER, F. W., JR. *Rev. Sci. Instrum.*, **18**, 918–24 (*Dec.*, 1947).—Gas samples of a few μl can be analysed to within a few % accuracy with the described system. Identification of components is made from condensation points, comparison readings of Pirani and McLeod gauges, and differences in speeds of flow. Condensation points at sub-liquid N_2 temperatures are obtained by evaporating liquid N_2 at reduced pressures. Except for the removal of CO and H_2 by ignition with O_2, and O_2 with a W filament, chemical methods have been eliminated. Transfer of minute gas quantities is greatly facilitated by use of small Hg diffusion pumps. A.

545.8 : 539.163.2 *see Abstr.* 1049

545.82 : 535.343.2–15 1111

Infra-red spectra of hydrocarbons. II. Analysis of octane mixtures by the use of infra-red spectra obtained at low temperatures. AVERY, W. H., AND MORRISON, J. R. *J. Appl. Phys.*, **18**, 960–7 (*Nov.*, 1947).—Infra-red spectra (2–22 μ) were obtained for 4 trimethylpentanes at 0° and −195°C, the hydrocarbon being condensed on the reflecting bottom of a cooled cell. Methods for forming films of reproducible thickness are described. Bandwidths at −195°C are $\sim\frac{1}{2}$ those at 0°C, and statistical calculations applied to a mixture of 18 isomeric octanes, with randomly distributed bands, show that this will increase to ~ 1 the probability that one band of at least 17 isomers will not be overlapped. The use of liquid He temperatures is discussed. A.

CRYSTALLOGRAPHY 548

48.0 : 537.529 : 539.166.08 *see Abstr.* 1055

48.0 : 539.16.08 *see Abstr.* 1037

48.0 : 539.166.08 *see Abstr.* 1054

48.0 : 539.31 *see Abstr.* 1088

48.0 : 535.343.2–15 *see Abstr.* 920

48.1.023 : 548.736.14 1112

The crystal structure of element 43. MOONEY, R. C. L. *Phys. Rev.*, **72**, 1269 (*Dec.* 15, 1947).—Technetium crystallizes in a hexagonal close packed arrangement. Cell constants are: $a = 2{\cdot}735 \pm 0{\cdot}001$; $c = 4{\cdot}391 \pm 0{\cdot}001$ Å. Calculated density = 11·487 g/cm³. W. E. D.

48.33 : 536.424.1 : 535.544 : 535.343.2 1113

Phase change in barium titanate crystals induced by infra-red radiation absorption. FIELD, N. J., DEBRETTEVILLE, A. P., JR., AND WILLIAMS, H. D. *Phys. Rev.*, **72**, 119–20 (*Dec.* 1, 1947).—Macrocrystals of the ferroelectric $BaTiO_3$ have been grown and examined between crossed Nichols. The optical properties of the crystals change from anisotropic to isotropic as the intensity of illumination is increased. The change is reversible. It appears that the infra-red from the W lamp used heats the crystal to a temp. above its Curie point (120°C). The original anisotropy can be restored by a breath of cool air or by the insertion of a daylight filter. Tentative measurements show that if there is a selective i.r. absorption band, it is very broad. W. E. D.

548.52 1114

Foreign ion rejection in the growth of sodium chloride single crystals from the melt. MCFEE, R. H. *J. Chem. Phys.*, **15**, 856–61 (*Dec.*, 1947).—A study is made of the process of purification that takes place when single crystals are grown from the melt. The rejection of K and Cu ions from solid solution in NaCl crystals is measured quantitatively by analysing by spectrochemical means sections of cylindrical crystals of NaCl to which has been added a known quantity of impurity. The theory of the distribution of impurity over the height of the crystal is derived in terms of the initial impurity concentration, height of completed crystal, and the fraction

of the impurity concentration in the melt included in the crystal, which fraction is called the purification coefficient. Good agreement is obtained between theory and experiment for an initial concentration of 0·1 atomic % K in NaCl. Purification coefficients for several crystals containing K and a few crystals containing Cu are measured and correlated with rate of growth and temperature gradient conditions. A.

548.7 : 535.375.5 *see Abstr.* 932

548.7 : 539.31 *see Abstr.* 1089

548.73 : 518.5 *see Abstr.* 803

548.73 : 77.012 *see Abstr.* 1138

548.734.3 : 669 1115

X-ray diffraction cameras for metallurgical specimens. DAVISON, D. W. *J. Sci. Instrum. Phys. Ind.*, **25**, 7–10 (*Jan.*, 1948).—In designing the cameras described, the aim has been to provide certain facilities which are particularly convenient for miscellaneous work on industrial specimens. At the same time maximum use has been made of straightforward design, and of materials easily obtainable. Two types of camera are described: (1) for "grazing-incidence" and (2) back-reflection. A.

548.734.52 1116

An integrating Weissenberg-apparatus for X-ray analysis. WIEBENGA, E. H. *Rec. Trav. Chim. Pays-Bas*, **66**, 746–8 (*Dec.*, 1947).

548.735.4 1117

Relations between structure-factors. GILLIS, J. *Nature, Lond.*, **160**, 866 (*Dec.* 20, 1947).—Certain inequalities must be obeyed by the structure factors, which in many cases enable the phase sign to be unequivocally determined from the amplitude values of the structure factors obtained by X-ray diffraction. These relations have been extended, enabling signs to be determined in many more cases. In addition, they lead to certain curious restrictions on the structure factors, for which no adequate physic reasons at present suggest themselves.

548.735.44 : 518.5 111

Remarks on some recently developed devices for summin Fourier series for crystal structure analysis. CHRIST, C. I *J. Appl. Phys.*, **18**, 1133 (*Dec.*, 1947).

548.736.14 : 548.1.023 *see Abstr.* 1112

548.737 111

Crystal structure of human carboxyhaemoglobi PERUTZ, M. F., AND WEISZ, O. *Nature, Lond.*, **16(** 786–7 (*Dec.* 6, 1947).

548.737 112

Crystal structures of zinc and magnesium benzen sulphonates. BROOMHEAD, J. M., AND NICOL, A. D. *Nature, Lond.*, **160**, 795 (*Dec.* 6, 1947).

548.74 : 537.312.5 112

The structure of photo-sensitive lead sulphide and lea selenide deposits and the effect of sensitization by oxyge WILMAN, H. *Proc. Phys. Soc., Lond.*, **60**, 117–31 (*Feb* 1948).—An exploration has been made, by electro diffraction and photoconductivity experiments, c deposits prepared by chemical deposition and b sublimation *in vacuo* or in oxygen. In spite of the larg variations in photoconductive properties which th deposits show as a result of treatments such as baking i vacuum or oxygen, the PbS and PbSe crystals were foun to have a lattice axial dimension which was constant t 0·1% in all samples measured, even in strongly oxidize deposits in which there was estimated to be 10–20% c the oxidation product, which was identified from it diffraction pattern as $PbO . PbSO_4$. The photo conductivity measurements, however, indicate that th sensitivity is associated with deviations from the stoichic metric compositions PbS and PbSe, and that oxyge treatments increase the sensitivity of PbS to wavelength between 1 and 3μ, but do not do so for PbSe.

GEOPHYSICS 55

550.367 : 539.163 1122

Geophysics and the radioactivity of potassium. BIRCH, F. *Phys. Rev.*, **72**, 1128 (*Dec.* 1, 1947).—Some of the geophysical implications of the new value for the $\frac{1}{2}$-life of K^{40} [Abstr. 182, 205 (1948)] are discussed. W. E. D.

550.38 : 621.396.11 : 538.566.3 *see Abstr.* 1013

550.38 : 621.396.82 : 538.566.3 *see Abstr.* 1014

550.383 1123

Blackett's fundamental theory of the earth's magnetic field. HALES, A. L., AND GOUGH, D. I. *Nature, Lond.*, **160**, 746 (*Nov.* 29, 1947).—Measurements have been made of the difference between the values of the earth's magnetic field on the surface and at a depth of 4 800 ft (Witwatersrand mine). The results, though they do not agree completely with the values calculated on the basis of Blackett's theory [Abstr. 1715 (1947)] are of the same sign and much closer to it than to those calculated from theories attributing magnetism to processes in the earth's core. Local geological uncertainties need to be eliminated by more extended observations.

550.93 : 539.155.2 = 3 1124

Age of uranium. HOUTERMANS, F. G. *Z. Naturforsch.*, **2a**, 322–8 (*June*, 1947) *In German.*—Assuming that ordinary Pb can be regarded as "natural" Pb containing "radiogenic" Pb as an impurity, the data of Nier on the isotopic constitution of ordinary Pb can be used to obtain the isotopic composition of "natural" Pb. A fairly good estimate of the age of terrestrial U can also be obtained. The ratio of the 204, 206, 207 and 208 isotopes of ordinary Pb is found to be 1 : 11·52 : 14·03 : 31·6, and the age of U is $(2·9 \pm 0·3) \times 10^9$ years There is satisfactory agreement between the origina composition of U and the present-day ratios of Pb/U and Th/U in the primary rocks from which Pb mineral have arisen, and the experimental values for granite The assumptions under which the age of U calculated i the above manner can be regarded as the age of th earth's crust or the age of origin of the elements ar considered. A. J. M

551.21/.22 = 82 112

Atmospheric electricity and lightning phenomena FRENKEL, Y. I. *Elektrichestvo* (*No.* 10) 5–15 (1946) *I Russian.*—A new dynamic theory of atmospheric elec tricity explaining cloud charges, thunderstorms, ioniza tion and conductivity of the air, is proposed. The cloud with their minute water droplets and ice particle generate the atmospheric electric field. The balance o charges, according to the theory, agrees with observation that at any given time 1% only of the earth's surface i clouded over. The initial ionization of the atmospher by cosmic rays is shown to lead under certain condition to rapid secondary ionization, and to creation of a con ducting air "channel" (lightning), and is also responsibl for large falling rain drops changing their charge fro − to +. A continuous accumulation of + charges o the upper and of − charges on the lower layers of cloud is accompanied by continuous dispersal of these charge to the ground. The theory is able to explain all know phenomena of lightning discharge characteristics, siz

thunder clouds, polarities of charges on droplets of rying size, etc. A. L.

1.465 : 532.59 *see Abstr.* 843

ATMOSPHERE . METEOROLOGY 551.5

1.508.5 1126

Two types of sensitive recording cup anemometer. EACON, E. L. *J. Sci. Instrum. Phys. Ind.*, **25**, 44–7 *eb.*, 1948).—The instruments are suitable for applica- ns where results of high accuracy are desired and for e measurement of light winds, the stopping speeds of e anemometers being as low as 0·15 m/sec. High nsitivity and constancy of calibration is achieved by nimizing the bearing friction and the torque necessary operate the impulsing device. A source of heat in the emometer body is found to be very effective in prevent- g bearing corrosion and consequent changes of friction. the first type a photoelectric impulsing system is em- oyed, while the second uses a very light electric contact conjunction with a thermionic valve. Photographic cording on bromide paper is found to be most con- nient. Both types have functioned satisfactorily during nsiderable periods of exposure to the British climate. A.

1.508.71 1127

Measurement of absolute humidity in extremely dry air. REWER, A. W., CWILONG, B., AND DOBSON, G. M. B. *roc. Phys. Soc., Lond.*, **60**, 52–70 (*Jan.*, 1948).—To meet urgent demand for a hygrometer capable of use at all ights in the atmosphere, the dew-point hygrometer, hich is shown to have many advantages, has been veloped primarily for use in aircraft to measure dew- oints, or rather frost-points, down to −90°c. It is ecessary that the instrument should operate at the owest possible frost-points as it has been discovered that he air in the stratosphere is very dry. Laboratory studies f the deposition of water and ice from the vapour at low emperature are described. Below −90°c it is not ossible to operate a frost-point hygrometer because the eposit is in the form of an invisible glassy layer, but the strument gives correct results at temperatures close to his limit. Details are given of the construction of ifferent forms of hand-operated hygrometers. A.

551.513 1128

Atmospheric turbulence. SHEPPARD, P. A. *Nature, Lond.*, **160**, 859–61 (*Dec.* 20, 1947).—A brief review of the development of knowledge of this subject is followed by an account of the contributions to a discussion at the Royal Astronomical Society.

551.524.7 : 534.222 *see Abstr.* 863

551.593.5 : 525.75 1129

The extinction of light of the night sky. PIOTROWSKI, S. L. *Astrophys. J.*, **106**, 466–80 (*Nov.*, 1947).—The distribution of brightness over the sky is analysed for the case in which the atmosphere is illuminated by rays coming from all directions of the sphere. On the basis of the equation of radiative transfer, simple formulae are obtained that are valid under the same restrictions (approximately) as the ordinary extinction formula $e^{-\tau \sec z}$ for a point-source of light. The application of the relations obtained to the problem of the determination of the height of the light-producing layer is given. A check of the deduced formulae is obtained by comparing the numbers resulting from these formulae with Abbot's experimental data. A.

551.594.221 : 537.525 *see Abstr.* 974

551.594.5 : 621.396.9 1130

Interpretation of radio echoes from polar auroras. HERLOFSON, N. *Nature, Lond.*, **160**, 867–8 (*Dec.* 20, 1947).—Quantitative consideration of the strength of the echoes observed by Lovell *et al.* [Abstr. 3748 (1947)] indicates that the electron density must $>4\times10^4$, and $<2{\cdot}6\times10^7$ electrons/cm^3. The former figure postulates a thin reflecting layer with sharp boundaries, and even the latter figure indicates diffuse boundaries <3 m thick. Since such boundaries could not persist as long as 20 min, it is suggested that the observed echoes were reflected from the vertical surfaces of a stationary discharge (auroral arc) at a height of 200 km above the brightest area.

551.594.6 : 539.15 : 538.222 *see Abstr.* 1007

551.594.9 : 537.122 : 523.53 *see Abstr.* 811

BIOLOGY 57/59

576.8.093.6 : 535.43.07 *see Abstr.* 940

576.809.514 : 614.485 1131

Killing air-borne respiratory micro-organisms with ermicidal energy. LUCKIESH, M., TAYLOR, A. H., AND KNOWLES, T. *J. Franklin Inst.*, **244**, 267–90 (*Oct.*, 947).—Describes the use of the low pressure Hg arc, iving practically all its u.v. energy at 0·2537 μ, for illing micro-organisms, particularly air-borne respiratory rganisms. The methods of measuring the effectiveness of a germicidal radiation are described, and results of nvestigations on the resistivities of various organisms and of the effect of humidity on resistivity are given. J. W. T. W.

591.185.63 : 525.37 : 531.114 1132

A preliminary study of a physical basis of bird naviga- lion. YEAGLEY, H. L. *J. Appl. Phys.*, **18**, 1035–63 (*Dec.*, 1947).—The theory presented implies an organ or organs in the bird's physiology which are sensitive to the effect of its motion through the vertical component of the earth's magnetic field and to the effort exerted to over- come the Coriolis force, due to the earth's rotation. Each of these influences involves a set of lines which together form a navigational grid-work. By correlating its instantaneous land speed with the two above effects, a bird can fly to its home which is a unique point in this gridwork, or to related companion points existing in the gridwork at positions other than its home. Experimentation with homing pigeons between the home and spurious home points (conjugate or companion points) which has yielded data in support of the theory is described in detail in the paper; 35 references are listed. A.

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.843.6 1133

The two-quanta explanation of the dependence of the threshold values and visual acuity on the visual angle and the time of observation. BOUMAN, M. A., AND VAN DER VELDEN, H. A. *J. Opt. Soc. Amer.*, **37**, 908–19 (*Nov.*, 1947).—It has been established experimentally that the observation of a small short light flash requires the absorption of at least 2 light quanta by the visual purple within a time τ ($\sim 0{\cdot}02$ sec) within an area corresponding to a visual angle D ($\sim 10'$). The evidence and theoretical justification is here recapitulated and discussed. Deviations occur for long flashes and wide angles, which suggest that after a time of $\sim 3\tau$, from the absorption of light quanta, the chance of observation of a second pair of quanta in the same neighbourhood ($\sim 3D$) is decreased. The results of other experimenters are discussed. A.

612.85 : 534.75 *see Abstr.* 890–3

612.858.71 1134

Audiometry by means of a continu audiogram. VAN EBBENHORST TENGBERGEN, J. *Proc. K. Ned. Akad. Wet.*, **50** (*No.* 9) 1176–8 (1947).—In this continuous recording device, the "patient" controls the "*f*" scale (the d.b. threshold of audibility) and the "investigator" controls the "*x*" or frequency scale. It appears to be possible to make a continuous audiogram in this way, even with children as young as 10 years. When the intellect is very low, the audiogram shows many irregularities. Patients varied considerably in their facility to recognize the auditory threshold. A. B. W.

614.485 : 535.247.4–31 *see Abstr.* 906

614.485 : 576.809.514 *see Abstr.* 1131

614.8 : 539.172.4 1135

Symposium of papers on the effects upon personnel engaged in nuclear fission work. *Radiology*, **49**, 269–365 (*Sept.*, 1947). *Presented at the 32nd annual meeting of The Radiological Society of North America, Chicago, Ill., Dec.* 1–11, 1946.—The production of plutonium for military purposes in the U.S.A. led to investigations concerning the biological effects upon personnel, carried out by a large number of investigators, under the general direction of Dr. R. S. Stone. The present papers are stated to be only a small proportion of the total results. R. E. Zirkle discusses the effects of slow neutrons and suggests no hitherto unknown mechanism is involved. E. Lorenz and others detail animal experiments and the practical considerations which arise. Blood changes of personnel are recorded by L. O. Jacobson and E. K. Marks, who conclude that prior information of tolerance and permissible dosage require modification. Physiological effects of the ionizing radiations, based on animal experiments, lead C. L. Prosser and others to the view that the effects of every type of radiation are similar and depend on the intensities only. Results of irradiation of animals with β-rays are discussed by J. R. Raper, and J. G. Hamilton describes the effects upon the metabolism of rats, particularly with respect to bone changes and destruction. W. Bloom found a definite effect upon the red as well as the white blood cells in animals exposed to the radiations. P. S. Henshaw and others discuss the effects upon mice submitted to periodic and slow exposures of fast and slow neutrons and gamma rays, the gener results being atrophy and neoplastic changes of the bloo cells. Cancer induction due to the various disintegratio products of plutonium have been produced in mice, ra and rabbits by H. Lisco and others. The symposium completed by an editorial article by R. S. Stone. B. J.

615.849 : 537.531 : 621.386.1 113

High-intensity radiation from beryllium-window X-ra tubes. ROGERS, T. H. *Radiology*, **48**, 594–603 (*Jun* 1947).—Developments in the production of malleable B has led to the commercial production of X-ray tub with Be windows, which are illustrated and describe The much reduced absorption gives a greatly increase exit of X-rays, comparative curves given for Be, Al an Pyrex glass showing the marked advantages of the forme This increased output is much greater than indicated b the usual dosage measuring instruments, due to th increased absorption of soft rays by the instrument wall Mesh and other suitable instruments are briefly men tioned. Such tubes were first employed for diffractio work with soft rays, but further probable applicatio are indicated, since intensities of 2 330 000 r/min hav been obtained with 50 mA at 50 kV. These tubes utiliz a 40° solid angle of emission, but the author has co structed a tube with a solid angle of 180° of emissio giving 5 000 000 r with 100 mA at 100 kV over an are of 25 cm². Such high emissions indicate future medic uses with respect to "Grenz" and "contact" X-ra therapy for skin and intracavity diseases, biologic applications, photochemical applications such as modif ing the colours of rare stones to preferred colour sterilization of bacterial cultures for the preparation vaccines, etc. B. J. I

616.12–073.96 : 621.317.39 113

Myographs. GILSON, W. E., AND EYSTER, J. A. E *Electronics*, **20**, 200, 202, 204, 206, 208 (*Nov.*, 1947).— Describes elements designed for placing over the hear of animals to observe displacement or velocity of muscul contraction there. Units based on a capacitance princip were unsatisfactory owing to capacitative changes with the heart itself and to flexing of the connecting cabl A resistance element made up of wet filter papers mounte in V-form were better, but showed drift. A variab mutual inductance appears satisfactory. H. G. M.

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666 : 537.228.1 = 5 *see Abstr.* 966

666 : 537.228.4 *see Abstr.* 967

666 : 539.216.1 : 539.32 *see Abstr.* 1090

666 : 539.4.019.1 *see Abstr.* 1098

669 : 548.734.3 *see Abstr.* 1115

678 : 535.551 : 539.31 *see Abstr.* 1087

678 : 539.264 *see Abstr.* 1082–4

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77.012 : 548.73 1138

On the alleged lattice dilatation of silver bromide during exposure. BURGERS, W. G., AND MESRITZ, E. A. *Physica, 's Grav.*, **13**, 490–500 (*Sept.*, 1947).—The results of Hess [*Physik Z.*, **44**, 245 (1943)] could not be confirmed. A change in lattice parameter was observed neither with X-rays nor with visible light. A.

771.534.533 = 3 1139

On the kinetics of photographic development processes, with particular reference to rapid-working, combined developer-fixers. KELLER, J. M., MAETZIG, K., AND MÖGLICH, F. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*No.* 6) 301–16 (1947) *In German.*—Useful data are given of gamma, rate of increase of gamma, max. and fog densities, optimum concentration of fixer and processing times at working temp. 18–30°C for Agfa positive and negative materials used with high *p*H, rapid-acting developer-fix solutions buffered with Al, Zn, Pb, and Pb–Al salt The mechanism of combined development-fixation discussed in relation to molecular reactions in the surfa layers of the developed AgBr grains. D. R.

771.534.581 : 535.345.6 *see Abstr.* 927

778.3 : 537.534.75 *see Abstr.* 982

778.33 114

Autoradiograph technique. PELC, S. R. *Nature, Lond* **160**, 749–50 (*Nov.* 29, 1947).—Photographic emulsio stripped from its base, deposited on to a radio-iodin containing thyroid section, and developed *in situ* aft suitable exposure, enables the active regions to be locate with great accuracy on the section, which is visible throug the emulsion.